

INTERNATIONAL INSTITUTE OF AGRICULTURE
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW
OF THE SCIENCE
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

YEAR VII - NUMBER 7
JULY 1916



ROME
PRINTING OFFICE OF THE INSTITUTE
1916

THE INTERNATIONAL INSTITUTE OF AGRICULTURE

The International Institute of Agriculture was established under the International Treaty of June 7th, 1905, which was ratified by 40 Governments. Fifteen other Governments have since adhered to the Institute.

It is a Government Institution in which each Country is represented by delegates. The Institute is composed of a General Assembly and a Permanent Committee.

The Institute, always confining its attention to the international aspect of the various questions concerned, shall :

(a) Collect, study, and publish as promptly as possible, statistical, technical, or economic information concerning farming, vegetable and animal products, trade in agricultural produce, and the prices prevailing in the various markets.

(b) Communicate the above information as soon as possible to those interested.

(c) Indicate the wages paid for farm work.

(d) Record new diseases of plants which may appear in any part of the world, showing the regions infected, the progress of the diseases, and, if possible, any effective remedies.

(e) Study questions concerning agricultural co-operation, insurance, and credit from every point of view: collect and publish information which might prove of value in the various countries for the organisation of agricultural co-operation, insurance and credit.

(f) Submit for the approval of the various Governments, if necessary, measures for the protection of the common interests of farmers and for the improvement of their condition, utilising for this purpose all available sources of information, such as resolutions passed by international or other agricultural congresses and societies, or by scientific and learned bodies, etc.

PERMANENT COMMITTEE OF THE INTERNATIONAL INSTITUTE OF AGRICULTURE

President: Marquis RAPPAELE CAPPELLI, Delegate of Italy.

Vice-President: M. LOUIS-DOP, Delegate of France.

List of the Delegates of the Permanent Committee:

1	GERMANY	I	Dr. T. MUELLER, Privy Councillor.
2	ARGENTINE REPUBLIC	I	Dr. OCTAVIO PINEIRO SORONDO.
3	AUSTRIA	I	Chev. V. DE POZZI, Government Councillor.
4	HUNGARY	I	E. DE MIKLÓS, Secr. of State, Member of House of Magnates.
5	BELGIUM	IV	O. BOLLE.
6	BRAZIL	I	ANTONINO FIALHO, Ex-Deputy.
7	BULGARIA	III	M. STANCIOFF.
8	CHILE	II	S. ALBUNATE, Minister Plenipotentiary.
9	CHINA	I	WANG-TSENG-SZE.
10	COLUMBIA	V	J. M. HURTADO, Minister Plenipotentiary.
11	COSTA-RICA	V	MARCO BESSO.
12	CUBA	V	M. A. MARTIN RIVERO, Minister Plenipotentiary.
13	DENMARK	IV	A. DE OLDENBURG, Chargé d'affaires.
14	OTTOMAN EMPIRE	I	Dr. MEHMED DJEMIL BEY.
15	EGYPT	II	B. CHIMIRI, Senator, Delegate of Eritrea.
16	ECUADOR	V	MARCO BESSO.
17	SPAIN	I	ENRIQUE RODRIGUEZ DE CELIS, Agricultural Engineer.
18	UNITED STATES	I	DAVID LURIN.
19	ABYSSINIA	V	Prof. G. CUBONI, Director, Station of Plant Pathology, Rome.
20	FRANCE	I	LOUIS-DOP, Vice-president of the Institute.
21	ALGERIA	V	LOUIS-DOP.
22	MOROCCO	V	LOUIS-DOP.
23	TUNIS	V	LOUIS-DOP.
24	GT. BRITAIN & IRELAND	I	Sir JAMES WILSON, K. C. S. I.
25	AUSTRALIA	III	Sir JAMES WILSON, K. C. S. I.
26	CANADA	II	Sir JAMES WILSON, K. C. S. I.
27	BRITISH INDIA	II	Sir JAMES WILSON, K. C. S. I.
28	NEW ZEALAND	IV	Sir JAMES WILSON, K. C. S. I.
29	MAURITIUS	V	Sir JAMES WILSON, K. C. S. I.
30	UNION OF SOUTH AFRICA	IV	Sir JAMES WILSON, K. C. S. I.
31	GREECE	IV	M. CORE MILAS, Minister Plenipotentiary.
32	GUATEMALA	V	G. MONTEFIORE, Consul General for Guatemala.
33	ITALY	I	Marquis R. CAPPELLI, Deputy, President of the Institute.
34	ERITREA & IT. SOMAL	IV	B. CHIMIRI, Senator.
35	TRINIDAD & GRENADA	IV	B. CHIMIRI.
36	JAPAN	I	Baron OTORI, Attaché to the Embassy.
37	LUXEMBURG	V	O. BOLLE, Delegate of Belgium.
38	MEXICO	III	G. A. ESTEVA, Minister Plenipotentiary.
39	MONTENEGRO	V	G. VOLPI, Minister Plenipotentiary.
40	Nicaragua	V	V. E. BIANCHI, Consul General.
41	NORWAY	IV	Dr. A. FRIESTAD, Counsellor to the Agricultural Department.
42	PARAGUAY	V	Prof. ORAZIO COMES, Director Portul Agr. College.
43	NETHERLANDS	IV	Baron W. B. R. de WELDEREN RENGENS, Minister Pléup.
44	DUTCH EAST INDIES	IV	Baron W. B. R. de WELDEREN RENGENS.
45	PERU	V	LOUIS-DOP, Delegate of France.
46	PERIA	IV	A. DEL GALLO, Marquis of ROCCAGIOVINI.
47	PORTUGAL	IV	ESPÉRIDO LEAO, Minister Plenipotentiary.
48	ROMANIA	I	DEMETRIU S. C. PENNESCO, Counsellor to the Legation.
49	RUSSIA	I	Hrs Excell. G. FARBELLO, Consul General for Russia.
50	SALVADOR	V	A. BIANCHI CAVALLI, Vice-Consul.
51	SAN MARINO	V	Hrs Excell. I. LOZZALI, Minister of State.
52	SERBIA	III	C. SCOTT, Consul General for Serbia.
53	SWEDEN	IV	Baron C. N. D. DE BILDT, Minister Plenipotentiary.
54	SWITZERLAND	IV	M. DE PLANTA, Minister Plenipotentiary.
55	URUGUAY	V	Dr. E. ROYRA, Consul.

General Secretary: Prof. GIOVANNI LORENZONI

In quoting articles, please mention this BULLETIN.

CONTENTS

FIRST PART: ORIGINAL ARTICLES.

J. H. L. DANNEFELD. The Present State of Agriculture in Sweden. Page 1-21

SECOND PART: ABSTRACTS.

AGRICULTURAL INTELLIGENCE.

I. — GENERAL INFORMATION.

AGRICULTURAL EDUCATION. — 721. Creation of a School of Silkworm Rearing in the Republic of Colombia.

DEVELOPMENT OF AGRICULTURE IN DIFFERENT COUNTRIES. — 722. The Organisation of the Cuban Agricultural Experiment Station.

II. — CROPS AND CULTIVATION.

A. GENERAL.

AGRICULTURAL METEOROLOGY. — 723. Temperature Changes due to Terrestrial Radiation and Relation of the Same to Plant Growth.

SOIL PHYSICS, CHEMISTRY AND MICROBIOLOGY. — 724. Soluble Non-Protein Nitrogen of Soil. — 725. Influence of Resin and Tannin on the Balance of Nitrogen in the Soil. — 726. Adsorption of Potassium by the Soil. — 727. Basic Exchange in Soils. — 728. Relation of Carbon Bivalent to Soil Organisms and Plant Growth. — 729. The Effect of Elemental sulphur and Calcium Sulphate on Certain of the Higher and Lower Forms of Plant Life. — 730. Factors influencing the Survival of Dried Soil Micro-organisms: Effect of Soil solution. — 731. New Russian Studies of Nitrogen-fixing Bacteria. — 732. Method for the Estimation of Hydrogen Ion Molarity in Soils. — 733. The Reaction of Soil and Measurements of Hydrogen Ion Concentration.

MANURES AND MANURING. — 734. Relation of Green Manures to the Failure of Certain Seed-lings. — 735. Hygienic, Scientific, and Economic Disposal of Human Excreta. — 736. The Solubility of "Emerson Slag" and Mineral Phosphates in Citric Acid. — 737. Potash in Banana Skins and Stalks. — 738. Waste of Tobacco Ash. — 739. The Question of Sulphate of Ammonia in Russia. — 740. Manuring Trials with the New Nitro-chlorine Manure "Guano 90" in Germany.

b) SPECIAL.

- AGRICULTURAL BOTANY, CHEMISTRY AND PHYSIOLOGY OF PLANTS.** — 741. Studies on the Root System of Plants in Reference to Selection and Drought Resistance. — 742. Changes in the Chemical Composition of Rye Seed through the Action of Some Species of *Fusarium*. — 743. Changes in the Specific Gravity and in the Starch and Dry Matter Content of Potatoes during Storage. — 744. Rapid Action of Saline Solutions on Living Plants: Reversible Displacement of a Part of the Basic Substances contained in the Plant. — 745. The Relations between the Presence of Magnesium in Leaves and the Function of Assimilation.
- PLANT BREEDING.** — 746. Comparative Tests of 4 Varieties of Barley at Torestop, Sweden. — 747. Comparative Tests with 8 Races of Oats, at Flahult, Sweden. — 748. Strawberry Breeding in the United States.
- CEREAL AND PULSE CROPS.** — 749. Sowing and Transplanting Rice on the "Dapog" Method, peculiar to some parts of the Philippines. — 750. Early Weeding of Rice Fields. — 751. Experiments in Manuring Rice with Burnt Paddy Husks, in Burmah.
- FORAGE CROPS. — MEADOWS AND PASTURES.** — 752. Accumulated Fertility in Grass-land in Consequence of Phosphatic Manuring.
- FIBRE CROPS.** — 753. Chemical Determination of the Fibre yield of Flax for the Purpose of Studying the Influence of Different Cultivation Factors on Such Yield. — 754. Piassava Industry of British West Africa.
- CROPS YIELDING OILS, DYES AND TANNINS.** — 755. Influence of Green Manure on the Germination of Oil Seeds. — 756. Investigations in Reference to Henna.
- STIMULANT, AROMATIC, NARCOTIC AND MEDICINAL CROPS.** — 757. Production of Medicinal Plants in Italy.
- FRUIT GROWING.** — 758. Bridge Grafting of Fruit Trees. — 759. The Fruiting of Trees in Consecutive Seasons. — 760. New or Noteworthy Tropical Fruits in the Philippines. — 761. The Brazilian Pitanga (*Eugenia uniflora* L.), an Excellent Fruit.
- VINE GROWING.** — 762. Direct-bearing Hybrids in the Regions of Côtes du Rhône, France, in 1915. — 763. Observations on Direct Bearers at the Royal Oenological School of Conegliano, Italy. — 764. An Interesting Problem in Connection with Radical Pruning.
- FORESTRY.** — 765. Program for the Triennial Period 1913-17 arranged by the Swedish State Institute of Experimental Forestry.

III. — LIVE STOCK AND BREEDING.

a) GENERAL.

- HYGIENE.** — 766. Injury to Livestock by *Simulium (Simulium)* in Hungary. — 767. The Possible Passage of Trypanosomes into Milk. — 768. Enquiries and Experiments in Connection with the Immunity of Cattle against Epizootic Foot-and-Mouth Disease.
- ANATOMY AND PHYSIOLOGY: GENERAL.** — 769. Osmotic Equilibrium between Blood and Milk in the Cow.
- FEEDS AND FEEDING.** — 770. Gradual Changes and Results of Feeding Experiments in Cattle.

b) SPECIAL.

- HORSES, ASSES AND MULES.** — 771. Spotted Asses.
- CATTLE.** — 772. The Miranda Breed of Cattle (Braganza, Portugal). — 773. Feeding Cows with the Subcutaneous Matter of Skins intended for Tanning. — 774. Skim Milk with an Addition of Sweetened Flour for Rearing Sucking Calves. — 775. Experiments to ascertain whether the Ability to produce Milk Fat is transmitted by the Dam or the Sire. — 776. List

- of Champion Cows of the 5 Principal Dairy Breeds of the United States in 1915. — 777. The Guernsey Breed of Cattle in Italy.
- Pigs. — 778. Experiments in Pig Feeding with Potato Meal. — 779. Experiments in Feeding Pigs with Straw Meal and Straw rendered Soluble by Caustic Soda. — 780. Value of Lucerne and other Green Forage in Pig Feeding.
- POULTRY. — 781. Experiments on the Necessity of adding Gravel to Poultry Food.
- BEES. — 782. Cold as the Cause of the Death of Bees in a Colony wintering under good Conditions.
- FISH. — 783. A New Skin Disease in Carp in Germany.

IV. — FARM ENGINEERING.

- AGRICULTURAL MACHINERY. — 784. Strecker's Liquid Manure Drill. — 785. Vasio Winnowing Machine. — 786. The Vasio Paddy Cleaning Machine, fitted to a Threshing Machine. — 787. Motor Driven Apple Grading Machine of High Capacity. — 788. A Tractor for the Garden. — 789. Experiments on the Fuel Used in Farm Portable Engines. — 790. Review of Patents.
- BUILDING CONSTRUCTION. — 791. Inverted Siphons Replace Bridges where Canals Cross Roads. — 792. Small Irrigation Canals Lined with Concrete to Prevent Seepage Water Loss.

V. — RURAL ECONOMICS.

793. Increase of Yield of the Soil in the Alpine Regions of Salzburg, Austria.

VI. — AGRICULTURAL INDUSTRIES.

- INDUSTRIES DEPENDING ON PLANT PRODUCTS. — 794. Table Wines and Blending Wines of Italy. — 795. The Wine of Grapes treated with Arsicates. — 796. The Determination of the Iodine Index of Alcoholic Liquids. — 797. *Pectinobacter amylophilum*, a New Organism which may be of Practical Importance in Flax Retting. — 798. New Method of Flax Retting Invented at the Technological Institute of Petrograd. — 799. Hats made of Chinese Palm Leaf.
- INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — 800. The Cheese Industry in Portugal.
- AGRICULTURAL PRODUCTS; PRESERVATION, PACKING, TRANSPORT, TRADE. — 801. The Measures to be Adopted for Preventing Unfair Competition in the Cheese Trade. — 802. Changes occurring in Potatoes during Storage.

PLANT DISEASES.

II. — DISEASES NOT DUE TO PARASITES, OR OF UNKNOWN ORIGIN.

803. Gummosis in the Citrus Plantations of Florida. — 804. Citrus Barkrot in the Philippines. — 805. "Porch Blight" on Douglas Fir in Oregon. — 806. Fruit Injury during the Fumigation of Citrus Trees: Causes and Remedies.

III. — DISEASES DUE TO BACTERIA FUNGI AND OTHER LOWER PLANTS.

- GENERAL. — 807. On the Original Range of *Spongospora subterranea*. — 808. Changes in the Chemical Composition of Rye Seed due to the Action of Certain Forms of *Fusarium*.
- RESISTANT PLANTS. — 809. Experiments on Smut Resisting Powers of Different Varieties of Wheat. — 810. Variation in the Resistance of Vines to Mildew.
- DISEASES OF VARIOUS CROPS. — 811. Morphology and Conditions of Development of the "Sclerotium Disease of Clover" (*Sclerotinia trifoliorum*). — 812. *Ustilina zonata* on *Hevea brasiliensis* in the Federated Malay States.
813. Fungoid Diseases of the Sugarcane at Tucumán (Argentina). — 814. Fungus Diseases of Coffee in Malaya. — 815. *Ascochyta hortorum*, a new Pest of the Artichoke in Italy. — 816. *Septoria Apii* var. *Magnusiana* and *S. Apii-Graveolentes* n. sp., injurious to Celery in the Neighbourhood of Petrograd. — 817. A New Disease of the Bamboo caused by *Scirrhia bambusae* n. sp., in Italy. — 818. *Ascochyta clematidina* on Stems and Leaves of Clematis. — 819. Investigations into a Disease of the Cones of *Pinus pinca* in Italy. — 820. Common Phosphorescent Toadstool (*Pleurotus nidiformis*) and "Sticky Timber Pholiotae" (*Pholiota adiposa*) Agaricineae attacking Wood, in Australia.

IV. — WEEDS AND PARASITIC FLOWERING PLANTS.

- GENERAL. — 821. Goatsrue (*Galega officinalis*) a Weed in New Zealand.

V. — INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

- GENERAL. — 822. The Entomological Society of Moscow, Russia. — 823. Insect Pests of Plants Cultivated in European Russia, in 1914. — 824. Diaspids Collected in Southern Italian Somaliland. — 825. Some Miscellaneous Economic Insects found in New Jersey.
- MEANS OF PREVENTION AND CONTROL. — 826. *Diplogaster labiata* n. sp. and *D. aerivora* n. sp. Nematode Parasites of *Sapryda tridentata* and *Leucotermes lucifugus*, in Kansas. — 827. The Efficacy of *Aphelinus silvestrii* in Control of *Chrysomphalus dictyospermi*, in Sicily. — 828. Efficacy of Various Arsenic Preparations in Control of Insect Pests. — 829. The Efficacy of Hot Water Treatment against "Cochylis" and "Eudemis". — 830. Bridge Grafting for saving Fruit Trees with Injuries due to Animals or Mechanical Causes.
- INSECTS ETC. INJURIOUS TO VARIOUS CROPS. — 831. *Triacnodes bicolor* and *Hydrocampa nymphaea* in the Rice Fields of the Province of Milan, Italy. — 832. *Tychius quinquepunctatus*, a Coleopterous Pest of Beans in Apulia, Italy. — 833. *Ligyris fossator* and *L. fossor*, Coleoptera attacking Sugar Cane, in Brazil. — 834. The Leopard Moth (*Zenzera pyrina*) a Dangerous Imported Insect Enemy of Shade Trees in the United States. — 835. *Pseudococcus cilii*, *P. bakeri*, *P. citrophilus* and *P. longispinus* in the Citrus Plantations of Southern California. — 836. The Woolly Whitefly (*Aleurothrixus howardi*) in Florida Citrus Plantations. — 837. *Icerya purchasi* in Florida, United States. — 838. *Bombyx pini*, a Spanish Pest of Pine. — 839. *Lyda hypotrophica*, a Hymenopterous Pest of Epicea in the Forests of Roggenburg, Germany.

The Bureau assumes no responsibility with regard to the opinions and the results of experiments outlined in the Bulletin.

The Editor's notes are marked (Ed.).

FIRST PART.
ORIGINAL ARTICLES

The Present State of Agriculture in Sweden

by

Professor H. JUHLIN-DANNFELT

Secretary to the Royal Academy of Agriculture in Sweden.

Since the remotest times, Sweden has been practically entirely an agricultural country. Half a century ago agriculture was still almost the only industry of the country, and production was sufficient for the needs of the population.

Since then the importance of agriculture has undergone a continuous decline. The proportion of persons directly deriving their livelihood from it has not kept pace with the increase in the population, or with the growth in the cultivated area. In 1870, rough calculations showed the agricultural population to form 71.9 % of the total, with 476 persons per 1000 acres of cultivated land, but in 1910 the corresponding figures were 48.2 % and 292 persons. Notwithstanding this, up till 1890 the agricultural population showed an increase in absolute numbers; after that date it fell from 2 915 000 to 2 603 000.

During the same period agricultural production became more and more inadequate to supply home consumption. In the period 1871-1880 the value of exported agricultural produce was on the average equal to that of imports (imports 52 932 000 kroner; exports 55 497 000 kr.) (1); between 1901 and 1910 the average for all imports was nearly double that of exports (110 409 000 against 55 474 000 kroner), and from that time till 1914 the discrepancy has continued to grow.

These facts, however, prove neither absolute stagnation nor decline of agriculture, its production having grown in greater proportion than the number of the population, namely 4 times as against 2.5 times in the course

(1) 1 Swedish *krona* = 18 s. 14 g. d.

of a century. The average value of a crop of the country has about doubled since 1880, with an increase of 50 per cent. since 1900. The consumption per head, however, has shown a still greater increase, rising in one century from 515.88 to 992.68 lbs of cereals and from 194 to 399 lbs of bread-stuffs (rye and wheat) per person.

The relative retrogression indicated by these facts is chiefly due to the rapid development of industry, which absorbed a constantly growing proportion of the rural population, leading to what is termed "the desertion of the countryside". The value of industrial products rose from 1000 million kroner in 1909 to 1772 million in 1912, while the crop value in the same period only went up from 600 to 900 million kroner.

To remedy this state of things various measures have been adopted for the promotion of agriculture. One of these was the reorganisation of the *agricultural administration*. In 1882 the administration of State forests and domains was placed in the hands of a new institution, the *Direction of Domains*, and 7 years later the *Department of Agriculture* was established as a central office for agricultural matters, which had till that time been dealt with by the executive Committee of the Royal Academy of Agriculture. In 1900 agricultural affairs were transferred from the Home Office to the newly created Ministry of Agriculture. Since 1889 the Academy of Agriculture, in its capacity as a scientific society has confined its work to the study of scientific questions in connection with agricultural experiments.

In the provinces, the chief intermediaries between the Government and farmers in all matters involving the welfare and progress of agriculture are the *Societies of Rural Economy*. Their duty is to work in their respective districts for the development of agriculture and allied industries, by education, by example, and by distributing rewards. They organise competitions, compile figures to form a basis of agricultural statistics, etc. They possess considerable resources, amounting in 1913 to about 4 million kroner (investments 400 000, members' subscriptions 50 000, public subscriptions 2 434 000, special appropriations 775 000 kroner).

The growing concern of the public authorities for the development of agriculture is also evident from the considerable increase of State expenditure for this object of late years. Such expenditure amounted in 1901 to 6.1 million kroner or 3.3 per cent. of the total estimates; in 1915 it attained 14.1 million kroner, or 5.2 per cent.

Agricultural wealth is continuously increasing, though more slowly than the total wealth of the nation. According to the official taxation assessment, the following were, in 1900 and 1914, the values of real estate in millions of kroner:

	1900	1914
Agricultural estate	4 385 52 %	4 792 38 %
Other estate	2 117 48 %	6 021 62 %
Totals	4 502 100	9 783 100

A special calculation made in 1908 gave the following values (in millions of kroner) for real and personal agricultural property.

Real estate.	3 679 = 26.6 % of the national wealth
Livestock	660 = 4.8 % " " "
Implements etc.	322 = 2.4 % " " "
Total	4 661 = 33.8 % of the national wealth

Needless to say, in a country as extensive and varied in character as Sweden, the ratio between the values of the different descriptions of property changes very much. Neglecting extreme cases, these values on normal farms may be estimated as follows per acre of land cultivated :

Land capital	160 — 800 kroner
Livestock	80 — 240 "
Implements, machinery, etc.	40 — 200 "
Working capital	80 — 160 "
Total	360 — 1 400 kroner

Agricultural Credit. — The real estate is generally encumbered with a considerable mortgage debt. For all the real estate together it amounted in 1912 to 51.7 per cent of the taxable value, but the share of agricultural property in this figure is not known.

Agricultural land credit is provided by 10 *District Mortgage Associations*, organised on the pattern of the German "*Landschaften*". The loans are granted by the *General Mortgage Bank* of which the said associations are the sole members. This bank operates under the control of the State, which provided it with a guarantee fund of 30 million kroner in State stock. The outstanding loans by the provincial associations amounted in 1913 to 291 million kroner, or 7.7 per cent of the value of the mortgaged property. These societies are resorted to chiefly by large real estate owners; small owners generally apply for the necessary advances to ordinary banks, public loan funds and private persons.

The provision of financial facilities for working capital has just been organised by a law of 1915 through the agency of *Local Agricultural Co-operative Societies* and Central Societies, but none of these institutions has yet begun to operate.

Association and co-operation, which at present play so important a part in the advancement of agriculture in most countries, did not gain a footing in Sweden until a late date. Latterly, however, they have made great headway concurrently with the growth of interest in the small farmer. The first co-operative dairies sprang up between 1860 and 1870, and, after various changes in organisation, multiplied until they numbered about 600, or 40 per cent of all the dairies of the country.

Later on, about 1885, farmers began to form associations for the joint purchase of fertilisers, concentrates and other primary necessities, and, in 1905, this co-operative movement resulted in the creation of the *National*

Union of Provincial Societies and Local Associations. The latter, now exceeding 1,000 in number, receive orders, effect the distribution of the goods purchased and collect payment. The provincial societies, at present numbering 22, receive orders and conclude transactions either direct with manufacturers and traders, or, in most cases, through the agency of the National Union, whose turnover in 1915 amounted to 24.5 million kroner.

The fundamental principle of this co-operation is the supply of goods at the market price of the day and the distribution of the profits among the participants rateably to the purchases of each. Associations or unions were afterwards formed to provide for almost all the needs of farmers in almost all branches of their work. These associations placed all the technical facilities of modern agriculture at the disposal of all growers, particularly small farmers, and assisted them to market their products to advantage, at the same time instructing them, by competent advice in all matters concerning agriculture and stock rearing. It is this latter point which lends importance to these associations in quite as great a degree as the economic advantages which they directly provide for their members.

The principle gaining ground more and more in these associations is that each member has one vote only, while participation in the profits and expenditure is in proportion to the shares held by each member or the area of his cultivated land, the number of his cows or the amount of his purchases or deliveries.

The present status of agricultural associations is shown by Table I containing statistics in reference to the different classes of economic societies in connection with Swedish agriculture.

TABLE I. — *Swedish Farmers' Economic Societies.*

Mortgage Credit Societies	10
Purchasers' Societies:	
National Union	1
Provincial Societies	22
Local Associations	1 100
Societies for the production of peat litter	30
Stock rearing Societies:	
Stud Societies (Horses)	160
" " (Bulls)	1 600
" " (Pigs)	600
Inspection Societies (for cowsheds, piggeries, etc.)	750
Poultry-keeping Societies and Egg Sales Unions	—
Co-operative Dairy Societies	700
Societies for exportation of Butter	2
Co-operative Butchers	—
Societies for the Sale of Seeds	—
Societies for the Sale of Market-garden produce	4
Societies of Fruit-growers	420
Fisheries Societies	—

Labour (1). — The relative decline of the agricultural population has exerted a perceptible influence not as regards the number of farmers (landowners and tenant farmers), but only as regards the number of labourers. It imposed greater economy of labour, but gave rise to no real difficulty in finding the necessary labourers for agricultural work and care of livestock, except in 2 cases :

1) For the extensive sugar beet cultivations in the south of the country, emigrant labour had to be engaged, coming chiefly from Galicia and Poland, to the number of 1 000 to 1 300 persons of both sexes.

2) There is a permanent difficulty in finding farm hands, male and female, to look after the livestock and milk the cows.

The shortage of labour has also led to a considerable rise in wages, which have increased threefold since 1870, the present yearly wage for a man being 320 kroner, and for a woman 180 kroner ; the day wage in summer (without board or lodging) is 2.5 kroner for a man and 1.5 kroner for a woman ; these figures are the averages for the entire country.

Wages are generally the largest item of farm expenditure, and therefore their rise, which far exceeds that of the selling price of agricultural produce, has been a powerful factor in weakening the economic position of agriculture.

Hired labour formerly consisted chiefly of farm hands, male and female, paid by the year against fixed salary and board and lodging in the farmer's house ; on rather larger farms, again, a considerable part of the work was carried out by peasants who were under certain obligations of labour or payment, and by persons (" *Torpare* ", " *Köthner* ") to whom small holdings are granted in consideration of a number of days' labour per week, with the right also of doing paid labour. Great changes have taken place in this respect. Farm hands of both sexes are generally quick and strong labourers, but owing to the trouble of finding them board and the difficulty of moral supervision over them, the attempt has been made to replace them by married labourers (" *Statare* ") receiving wages and lodging ; the latter, however, instead of being fed in the employer's kitchen, receive a given quantity of the most important commodities, for instance, about 24 cwt. of rye ; 22 bushels of potatoes ; 6 or 8 cwt. of wheat for feeding livestock (pigs) per year ; 5 $\frac{1}{3}$ pints of full-cream milk per day, the same quantity of skim milk ; wood fuel, and a piece of land for planting potatoes.

The forced labour tribute due from certain peasants either in the form of days of work or particular kinds of work, has long since been replaced by payment of a tenancy rent in money ; among the " *Torpare* " who occupy the above small holdings, the tendency to pay their dues by working them off has become more and more general. This form of contract is extremely favourable, both to the landowners who obtain labourers at the cost of the rent of patches of land of little value transferred to the latter, and to the tenants who thus have their own home, while their livelihood is secure, as they are always certain to find work on the owner's farm.

¹ See *International Review of Agricultural Economics*, February, March and April 1920.

Notwithstanding these mutual advantages, however, the number of such tenants shows a tendency to decline, and the difficulty of finding new ones becomes greater and greater. Consequently, agricultural labour continues to be supplied by farm hands, male and female, engaged by the year or for six months, but in the case of large agricultural estates, chiefly by "Statare", or married labourers, who receive wages in money and in kind and are also bound to allow their wives to assist, for an agreed payment in milking the cows and in harvest work. In all cases, however, the endeavour is to reduce the number of labourers on fixed contract as much as possible, replacing them by day or job labourers.

THE CULTIVATED LAND AND ITS UTILISATION. The total area of land in Sweden is about 101,400,000 acres divided as follows :

TABLE II. — *Division of Land in Sweden.*

	Area in acres	% of total area
Gardens	113 671	0.1
Arable land	9 085 867	9.0
Natural grass-land	3 148 054	3.1
Forest	54 942 685	54.2
Unproductive Land	34 107 213	33.6

Nevertheless, owing to the great size of the country (extending between latitudes 55°2' and 69°4') and its geographical and geological configuration, there is a great difference in the relative proportions of the different kind of land both between north and south and between the mountain and forest stretches of country with moraine soil in the interior and the clayey or sometimes sandy plains bordering the coasts between the Baltic and the Kattegat. The extremes are represented by the province of Scania, where cultivated land forms as much as 60 per cent. of the total area, and that of Norrbotten, in which less than 0.4 per cent. of the land is cultivated. The area of cultivated land is continually on the increase, chiefly through the reclamation of marshes, but the proportion of increase shows a constant decline. 25 years ago the increase was usually 74 133 acres per annum, but during the last ten years it has only been 24 711 acres per year. This is a consequence of the increased cost of labour. The bulk of the reclamation work is carried out with the assistance of the Government, which in 1915 for instance appropriated 1 400 000 kroner for loans with that object, and 2 350 000 kroner for grants not subject to repayment.

Clearing work is principally carried out on the peat soils, which have gone up greatly in value for cultivation purposes since rational fertilisation was rendered possible by the use of artificial manures. The results obtained in this direction were due to a large extent to the investigations of the *Swedish Marsh Reclamation Society*.

Small farms show a continuous increase at the expense of the large ones, the number of which is constantly decreasing. The former total about 360 000, besides which there are about 140 000 small holdings, mostly al-

otted to labourers against payment in the form of labour for the landlord. It is calculated that on about 70 per cent. of the independent farms, and in all the holdings, the area of cultivated land does not exceed 25 acres, which means that they can be worked without hired labour. Farms averaging 25 to 124 acres of cultivated land represent 28 per cent and large states with more than 124 acres of cultivated land a little more than 2 per cent. of the total number.

The area of cultivated land is divided as follows among the different classes: one half belongs to farms of medium size; about one fourth to small farms; and the same to large estates.

This distribution, however, varies greatly in different parts of the country, the large estates, particularly manorial estates, lying chiefly in the fertile plains, while the small ones are in the uplands where the cultivated land is scattered among the mountains, rocky hills, marshes and streams. In the northern forest districts in particular there are hardly any but small tenant farmers, the land belonging mostly to big forest estates. Increased facilities of transit and industrial development have also to some extent affected the distribution of agricultural property, small farms being numerous in the neighbourhood of large towns, industrial centres and railway junctions.

In Sweden the land is for the most part tilled by the owners themselves, in the proportion of about 85 per cent.; the larger the acreage of farms the greater the proportion worked by tenant farmers. The position of the latter towards the landlord has been greatly improved by the new laws of 1907 and 1909 on tenant farmers. In the northern provinces, especially, where a large proportion of the land belongs to commercial companies, the rights of the landlord have been restricted in favour of the tenant farmer.

Measures for the Benefit of Small Farms. The great increase in the number of small farms is partly due to the attempts made to stem townward migration. In order to facilitate land settlement by small farmers, the State has for some time been selling the land in small plots. All Crown domains not yielding a minimum which was fixed in 1874 at 200 and in 1892 at 600 kroner, are put up for sale when the farm leases expire. Under the decrees of 1894 and 1899, moreover, those parts of Crown domains which are suitable for forming separate farms must be split up and put up for sale or let. Between 1894 and 1912, about 1800 small farms were sold in the central and southern part of the country. In the northern provinces, portions of forest domains suitable for cultivation are allotted rent free for the first 15 years, and for a moderate fixed rent during a further 50 years. The primary object of these grants was to provide the public authorities with the necessary labour for forest maintenance, but no obligation in this respect is imposed on the settlers. The number of holdings of this kind is about 1200.

Division into small holdings is greatly facilitated by the simplicity of legal formalities, chiefly owing to a law of 1896 which enables cultivated land to be separated from forest, the latter being more difficult to work in small plots. This law however does not apply to the northern provinces, where agriculture could hardly be self-supporting without the contribution

of the forests to the financial return. The Government has encouraged the increase of small farms by a system of financial facilities. Loans are granted up to the amount of $\frac{5}{6}$ ths of the value of the land and buildings, at 3 per cent interest with repayment over a long period. Between 1905 and 1913, about 8 900 loans were granted representing a total slightly above 25 million kroner.

For a quarter of a century the small farmer has also been provided for in other respects by the public authorities, having been the chief one to profit by the subsidies granted for the reclamation of waste land and the development of stock rearing, and also by the assistance furnished by scientific agriculturists in the service of the State or rural economy Societies.

The Government furthermore allocates every year a certain sum (now 400 000 kroner) for the encouragement of the small farmer in the following ways :

- (1) Premiums for the clearing of small areas of brushland etc.
- (2) Competitions between small farms with premiums and conditional loans (totalling about 50 000 kroner per year) for works of improvement ; if the work has been carried out satisfactorily within the time fixed, the repayment of the loan is postponed.
- (3) Subsidies to Inspection Societies and Societies for the proper keeping of books of account on farms.
- (4) Educational courses (in 1913, 264 courses at a total expenditure of 71 000 kroner) and excursions for agriculturists, male and female (in 1913, 810 persons took part), with subsidies totalling 61 000 kroner.

Crops. — The types of crop grown differ greatly according to climatic and soil conditions, and general farming standard. The simplest methods of cultivation are practised in the north. Grain growing is very limited there owing to the short summer ; it only extends over 10 to 30 per cent. of cultivated land, and mostly comprises spring cereals; chiefly 4-rowed barley which is the earliest, while winter wheats, which occupy the land for 2 summers, are less suitable. Fallowing is only applied before the winter wheat. Towards the south, oats gain the upper hand. Artificial grass-lands cover a wide area (averaging 60 per cent. of the cultivated area) in the northern provinces, and are left uncleared for a longer or shorter period of time (up to 20 years) in the more northerly parts.

In the central and southern portions of the country there is greater equality of distribution of the different cultivations. In proportion as the general farming level improves, fallowing and laying down to grass decreases, while on the other hand grain crops and pulse crops for green or dry forage increase ; above all there is a large increase in root crops or forage.

In those parts of the country where farming practice is on a lower plane the most usual rotations are as follows : 1) fallow ; 2) winter cereal (rye and wheat) ; 3-5) artificial grass-lands; 6-7) spring cereals (oats and barley), pulses (peas and vetches) and mixed crops. An almost equal proportion (about 40 %) of the land in this part of the country is under grain and

leys, 10 to 15 per cent. of the land being fallow, 3 to 4 per cent planted with potatoes and 0.5 to 1.5 per cent with forage root crops.

In the districts where farming practice reaches the highest level, fallowing often disappears, the soil being tilled by harrowing and ploughing in, especially after the hay and green forage crop; the land is only sown to grass for one or two years, and to the extent of 15 to 20 per cent of the acreage cultivated. The greater part of the land is under grains and pulses, cropped when ripe or as green forage. Finally, particular attention is given to root crops, which may occupy up to 25 per cent of the arable land. As examples of the rotations practised in these districts there may be mentioned: 1) green forage (peas, vetches, oats and barley); 2) winter cereals (particularly wheat); 3) root crops (sugar beet and forage roots); 4) spring cereal; 5) grass; 6) spring cereal — or else 1) root crops; 2) spring cereal; 3) grass or green forage; 4) winter cereal.

The distribution of the different types of cultivation varies greatly according to the quantity of soil and the climate. Winter cereals are chiefly cultivated in the plains, where they take up 15 to 20 per cent of the cultivated land, wheat only in clayey soils, and rye in sandy soils also, where, together with potatoes, it forms the most important crop. In marshy soils winter cereals do not stand the climate well. Wheat, which is more exacting than rye as regards the nature of the soil, on the other hand furnishes a greater yield under favourable conditions and its cultivation has been considerably extended of late years.

Barley and oats are only grown as spring cereals, barley, (4-rowed) chiefly in high lands with light stony soil; oats everywhere, except in the north of the country, cover the greater part (up to 30-40 %) of the cultivated land, being chiefly planted on lean and also marshy soils. 2-rowed barley is only grown in the plains, chiefly on the best soils with a sufficient proportion of lime.

Peas and vetches are almost everywhere grown mixed with oats and barley, rarely alone; this crop is chiefly raised on soils rich in lime. Beans are entirely limited to the lands skirting the west coast.

Potatoes are cultivated on all the farms of the country, generally in proportion to local need, so that almost everywhere the same proportion of the land is allotted to this crop (3 to 5 %). In the southern provinces alone, where the soil is sandy, the area planted with potatoes is considerably larger, the excess of the crop over local consumption being used chiefly for the manufacture of alcohol and starch. Root crops are mostly grown in the south of the country, where the sugar beet, under intensive cultivation, is of great importance from the point of view of rural economy. In Scania this crop occupies 10 per cent of the cultivated land, while in the other provinces it rarely exceeds 1.5 to 2 per cent. It receives special attention owing to its importance in crop rotation and for stock rearing.

Natural grass-lands were at one time very extensive, but have now largely been brought under cultivation, the remainder now occupying only one-third of the productive surface. Most of these grass-lands receive no cultivation or manuring whatever and their yield is consequently

rather low, probably not averaging more than 12 cwt. of hay per acre. Of late years, following German example, the grass-lands have begun to be used for grazing on rational lines, producing a considerable increase in their yield.

Seeds. — Grain and leguminous (pea, bean and vetch) seeds as well as seed potatoes are obtained from home crops exclusively. Until lately on the other hand, seeds of forage plants (including root crops) were mainly imported. This is of course a weak point, but it does not mean that with the majority of these plants there is any difficulty in growing good quality seeds within the country. On the contrary, Swedish seeds are held in high esteem because of the certainty of their being suited to the country, and of the guarantees obtainable as to purity.

With regard to pasture grasses, the majority of the most common species, timothy, red clover and hybrid clover are cultivated. Red clover is distinguished into the early and late varieties, the former being used for sowing leys of 1 or 2 years duration, particularly in southern Sweden, and the latter for longer periods. Both late and hybrid clover seeds are grown chiefly in the country, while those of early red clover are almost entirely imported. They are termed "Silesian clover seeds", but they are also imported from Bohemia, Moravia, and especially Russia. French, Italian and American red clovers are wanting in powers of endurance, and are therefore not rated very high. To facilitate verifying the origin of seeds, a law of 1909 provides that red clover, hybrid clover and timothy seeds must when imported be dyed red with eosin. Seeds of pasture grasses (except timothy seeds) and for root crops are still mostly imported, but during the last few years the most common forage plants in addition to timothy such as cocksfoot, rye grass and brome grass, as well as radishes, turnips, carrots and sugar and forage beets have begun to be grown for seeds to an ever increasing extent and with perfect success.

Seed testing. — There are 17 establishments receiving Government grants and operating according to official regulations which are substantially the same in Scandinavian countries. This testing has been carried on for 40 years (since 1877), and as a result the quality of the seeds put on the market is generally fairly satisfactory, and adulteration is rare.

Yields. — The averages in Sweden (wheat, 16.72 cwt per acre, rye 12.74 barley 12.74, oats 11.94, potatoes 79.65, sugar beet 238.90, forage roots 278.78) are almost the same as the average figures for Europe. They are below those of other Germanic countries, but higher than of Slavonic and Latin countries, except Belgium. These averages, however, like the level of agriculture, vary greatly in the different parts of the country. In the best regions they approximate to the crop value of the countries leading in this respect. The constant increase of yield recorded during the last decade justifies the hope that progress will continue.

This progress in yield is largely due to the fact that the old seeds have been replaced by better grades coming mainly from the Svalöf Institute, which enjoys the highest repute even outside the country for

its work of improvement of crops (I). The varieties of oats and barley which are most grown in the country give on the average a crop 15 to 29 per cent. bigger than that of the old-variety, and the latest improved wheat, though only grown to a small extent so far, shows a still higher superiority over the old varieties. Of course progress in this respect is chiefly observable in the southern and most fertile portions of Sweden, while the difficulty of increasing the yield by seed improvement increases in proportion as the summer becomes shorter, the soil poorer and the climate drier.

Agricultural Improvements. — The increase of yield is partly the result of land improvements and progress in cultivation work. *Drainage* is of the utmost importance in a country where the land is so hilly and broken and the soil is as retentive of moisture as clay and peat soils. This matter however, is still largely neglected, a large portion of the land being drained by open ditches only, and drainage by covered conduits and pipes making but slow progress owing to the high cost of labour. To encourage covered drainage on small farms, the Government grants loans at low interest.

Progress is more marked as regards *ploughing*, which is now done deeper, generally to at least $7\frac{3}{4}$ inches but often to 10 inches. Attention is also given to methodical utilisation of the soil moisture, which is of the utmost importance in a country where the rainfall during the 6 summer months usually does not exceed 13.3 inches and during each month of the spring and early summer (May and June) is only 0.78 to 1.57 inches.

In ploughing during spring and summer the principles of dry farming are generally applied, that is to say, the soil is usually consolidated so that the capillary moisture can rise from the deeper strata, and the surface layer is loosened to prevent loss of moisture by evaporation.

The striking development of the industry of *agricultural machinery* in Sweden has been a factor in more effective and scientific tillage. This industry supplies the country with machines and implements which meet farming requirements, and it has now made such strides that whereas in former years a considerable quantity of such machinery was imported, it is now exported to a value of 12 to 15 million kroner.

Manures and Manuring. — *Liming.* The regions where the land is made up of limestone rocks, belonging chiefly to the Silurian formation, far exceed in fertility those poor in lime and belonging mainly of archaic origin. The manures used in these regions are, to a large extent, either finely ground limestone or lime, and also, but only to a small extent nowadays, marl. In order to promote the use of these effective means of increasing fertility, the Government makes a grant towards the cost of carriage of lime for manuring purposes.

Farmyard Manures. — As, comparatively speaking, there is plenty of livestock, there is no shortage of *stable manure*, which has latterly been put to more effective use. Instead of manuring only once per rotation, as was done formerly, the manure is now spread over several breaks, so as to

11 See June 1913: pp. 851-860, The Swedish Svalof Institute, by N. Hjalmar Nilsson. pp. 861-870: Wheat and Oat selection at Svalof, by H. Nilsson-Ehle.

render its effect more uniform and complete. Greater care is also taken to preserve the fertilising elements, especially the nitrogen, in the manure. The stable manure is usually mixed with peat litter and compost. It has become more and more usual to provide the dung pit with a concrete bottom, and, on small farms, to keep the dung heap in a special shed.

The use of *chemical fertilisers* is still very limited. On marshy soils very poor in phosphorus and potash, potassium phosphates and salts are still used, and on soils poor in humus, for grain and root crops, phosphates and Chili nitrate or cyanamide are also in general use, but the quantities are too small to produce a maximum yield. The chemical manures are chiefly imported from abroad. Superphosphate and cyanamide, however, are manufactured within the country in quantities exceeding home consumption, the crude phosphates for the former being in turn imported. Two steel works also produce phosphated slag, but the supply from this source does not suffice for even half the consumption. Attempts have been made at different times to obtain potassic manures from the abundant strata of rocks with high potash contents in the country, but without success hitherto. The quality of chemical fertilisers is tested at 9 chemical Stations which receive State grants.

SECOND PART. ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

721 - **Creation of a School of Silkworm Bearing in the Republic of Colombia.** — *Revista agrícola, Órgano del Ministerio de Agricultura y Comercio*, Year 1, No. 11, pp. 642-644. Bogotá, November 1915.

AGRICULTURE
REUCATION

By law No. 13 of 1915 the Government of Colombia provided for the encouragement of the silk industry which may prove a source of wealth to the country. In pursuance of this law, some trials of mulberry growing and silkworm nurseries having proved successful at Bucaramanga, there was created in that town, by decree No. 1989 of 1915, a School of silkworm rearing to which an annual appropriation of 1860 pesos (£387.10 s. at par) has been made, to which there will be added the proceeds of the silk produced, woven and sold by the School.

722 - **The Organization of the Cuban Agricultural Experiment Station** (Progress of Agricultural Science in Cuba). — CRAWLEY J. T. (Director of the Cuban Agricultural Experiment Station). *Modern Cuba*, Vol. 5 (8), No. 2, pp. 28-46, Havana, Feb. 1, 1916.

DEVELOPMENT
OF
AGRICULTURE
IN DIFFERENT
COUNTRIES

The Cuban Agricultural Experiment Station was established at Santiago de las Vegas in 1904 by the first President of the Republic of Cuba.

The Station is divided into Departments, each with its chief, assistants, and necessary laboratory and other facilities, as follows.

- 1) *Agriculture*. — To this Department is given the experimental work with the more important crops, such as sugar cane, tobacco, corn and the various crops used for cattle feed, and green manuring.
- 2) *Horticulture*. — This has charge of the growing of fruits and vegetables, and the care of the grounds.
- 3) *Botany*. — This Department has gathered and cares for an herbarium of Cuban plants, and has charge of the study of forest trees, their distribution and utilization, vegetable fibres, medicinal plants, etc.

4) *Chemistry*. — Analysis of soils, fertilizer and agricultural products; not only those originating in the Station but those sent from without. This Department also has certain well-defined fertility problems for investigation.

5) *Pathology and Entomology*. — This is one of the most important Departments, since it has to deal with the difficult problems of the study of insect and plant diseases and proper methods for eradicating them. The problem has been more difficult owing to the fact that the tropics offer ideal conditions for the development of plant enemies, both insect and fungoid, and since so little work of this kind has been done in the tropics.

6) *Animal diseases*. — The laboratory carrying on investigations in animal diseases, and engaged in preparing vaccines and serums, was established under the direct supervision of the office of the Secretary of Agriculture and was transferred to the Station in March 1914. While it has the study of animal diseases in general, its principal work at the present time is the preparation of vaccines used in combating anthrax, black-leg, and hog cholera.

7) *Veterinary Medicine and Animal Husbandry*. — This Department is charged with the introduction and breeding of the best breeds of domestic animals, the study of butter and cheese making, the feeding values of various Cuban-grown feeds, and also the study of animal diseases.

While each Department has its own apparatus and problems, yet there is no fine line of demarcation between them and the closest cooperation among all officers is fostered.

CROPS AND CULTIVATION.

723. *Temperature Changes due to Terrestrial Radiation and Relation of the Latter to Plant Growth*. — ROSTER GIORGIO, in *Atti della Reale Accademia dei Geofisici*, Firenze, 163rd Year, Part I, pp. 1-27, Florence, January 1916.

The altitude chosen for meteorological observatories, their inevitable northerly exposure, and the arrangements for protecting the instruments from local influences, create an artificial environment differing too much from that of plant life. Consequently the information gained hardly admits of application to such life. The proper course would be for all determinations made for purposes of agriculture (such as mean temperature of seasons, months and days, mean and absolute extremes, heat variations at short intervals causing variability of climate) to be conducted under heat, light, wind and moisture conditions as near as possible to those of plant life.

Maximum and minimum thermometers are best placed in the open air. If there is only one instrument it should be put at a height of 3 ft. 3 ins.; a second, if available, at a height of 6 ft. 6 ins. A third might very usefully be put under high timber trees at a height of 4 ft. 11 ins., in order to ascertain what amount of protection from terrestrial radiation these trees afford to plants under cover of them. In his garden of Otonella, island of Elba, Italy, the writer found that a thermometer placed under the dense

foliage of a carob tree shows minimum temperatures 3 to 4 degrees Centigrade above those of a thermometer in the open air.

In the same garden, from March to September 1913, observations were taken of the daily variations of temperature by means of a registering thermometer 20 ins. from the ground, receiving all the heat of the direct solar rays and those reflected by the soil, exactly as in the case of plants. These observations show daily ranges sometimes approximating 40° C. (104° F). This confirms the great capacity possessed by plants for adapting themselves to wide variations of temperature.

In another series of observations made in 1911, 1912, 1914 and 1915, the amount of terrestrial radiation in the belt of air in closest contact with the soil was determined. A thermograph was placed in the open air 20 in. from the ground, and another a short distance away 55 in. from the ground, facing north, and protected from the sun and terrestrial radiation. Thus the differences in the fall of temperature, due in particular to morning radiation, were ascertained. The results are set out in a series of tables, and the following conclusions are based on them.

(1) Using two registering thermometers, A and B, at the above respective distances from the ground, the minimum daily temperature is registered by that nearest to the ground. This fact comes out very clearly, the difference often being most marked and not subject to any exceptions.

(2) The annual mean of 470 observations calculated from the monthly average minima was 19.2 degrees by thermograph A (4 1/2 ft. from the ground) and 16.6 degrees by thermograph B (1 ft. 7 1/2 in. from the ground).

(3) The annual average of the absolute monthly minimum was 15.7° by thermograph A and 13° by B.

(4) The absolute minimum for the 4 years was 11.6° by A and 6.4° by B.

(5) The differences between the minimums of the two thermographs in the 470 observations, taking their average and their maximum value, are summed up as follows:

(a) The monthly mean difference A -- B was 2.3° C.

(b) The mean of the maximum monthly differences was 3.8°;

(c) The absolute maximum difference throughout the period in question reached the high figure of 5.4°.

These results prove beyond question the importance of the study, in connection with vegetation, of the temperature changes due to terrestrial radiation, which are perfectly distinct from the general cooling of the atmosphere and occur in the lower air strata, the medium of plant life.

721 - **Soluble Non-Protein Nitrogen of Soil.** -- POTTER R. S. and SNYDER R. S. (Iowa State College Experiment Station), in *Journal of Agricultural Research*, Vol. VI, No. 2, pp. 61-64. Washington, D. C., April 10, 1919.

The writers conclude from their researches into the nitrogenous substances of the soil that information may be obtained relative to the degree of decomposition of the organic matter in the soil by determining the proportion of nitrogenous compounds left in the alkali extract of the soil after precipitation of the protein by a suitable reagent. With this problem in

SOIL PHYSICS
CHEMISTRY
AND
MICROBIOLOGY

mind, they determined the nitrogen in alkali extracts of soil with or without the addition of proteins and other organic nitrogenous compounds. The proteins were precipitated by trichloroacetic acid.

The principal consequence of the results obtained appears to be that the alkali extract does not contain a definite group of nitrogenous compounds. In any case, however, the non-protein fraction remaining in solution after precipitation by trichloroacetic acid may contain most of the simpler nitrogenous compounds, and therefore its determination would give an index of the degree of decomposition of organic matter in the soil.

A bibliography of 8 works completes the article.

725 - **Influence of Resin and Tannin on the Balance of Nitrogen in the Soil.**—KOCHE ALFRED and OELSNER ALICE, in *Centralblatt für Bakteriologie, Parasitenkunde und Infektionskrankheiten*, Vol. 45, No. 1-5, pp. 107-118. Jena, February 26, 1916.

In previous experimentation with forest soils (deciduous and coniferous respectively) one of the writers found that in soils containing nitric nitrogen the proportion of the latter was reduced after adding tannin or resin. These two substances greatly reduced nitrification, but without stopping it completely.

Tannin and resin being important products of vegetable metabolism, it was proposed to study their influence on the soil on the basis of previous experiments. The fact that a soil fertilised with sulphate of ammonia contains only a small amount of nitric nitrogen when the above two substances are present may be explained in two ways: a) the two substances may unfavourably affect the nitrifying power of the bacteria; b) nitrification is not impeded, but the nitrates formed are afterwards decomposed. The former hypothesis seemed the more probable, tannin and resin being used as antiseptics in leather tanning.

Influence of Resin. In GILTAY's solution citric acid was replaced by resin, after which bacteria obtained either from horse dung or from the soil were put in. A few days later a reduction of nitrates by the bacteria was found to have taken place. In the same solution without bacteria no reduction of the nitrates was observed, from which it is concluded that resin exerts no chemical action on the nitrates.

In further experiments 5 gr. of resin and 0.025 gr. of sodium nitrate were added to 100 gr. of dry earth. After 4 weeks there was no further trace of nitrate in the soil. The total nitrogen content being unaltered, it is concluded that the bacteria had not decomposed the nitrate into free nitrogen, but had used it to build up their cells. This very interesting fact proves that resin, which is so difficult of solution in water, supplies energy to the denitrifying bacteria enabling them to reduce the nitrates in the soil.

The experiments were repeated both with GILTAY and RAULIN solutions, and it was found that the latter, owing to the potassium carbonate it contained, promoted the conversion of nitrates a little more than the former. The behaviour of resin in the presence of alkalis also showed that when alkalis or salts are present in the soil, the resin is decomposed into substances which can be utilised by the bacteria. Resin is therefore clearly a source

of energy to the denitrifying bacteria of the soil, and for this reason coniferous forest soils contain less nitrates than others.

Influence of Tannin. For 2 months the nitrification of soil samples to which 5 % and 10 % respectively of tannin + 2 grms of ammonium sulphate had been added was studied. It was found that the soil treated with 10 % of tannin contained less nitrates than that treated with 5 % of tannin, just as in the observations relating to resin. The same experiments also showed that the organisms which converted the nitrates of the soil utilised tannin as a source of energy. It becomes clearly evident that a soil rich in tannin must be poor in nitrates. The studies undertaken in order to ascertain the soil organisms which utilise both tannin and nitrates disclosed the presence of a fungus, *Aspergillus niger*, sometimes accompanied by other fungi. Contrary to the general belief, this *Aspergillus* abounds in the soil, but only works under given conditions, namely when the soil is rich in tannin. It decomposes the latter and reduces the nitrates to nitrites. Sugar is the component of tannin which it uses, but there are probably others also. The presence of calcium carbonate increases its decomposing power. Like bacteria, *Aspergillus niger* uses nitrates as a source of nitrogen, and also salts of ammonia when the soil contains tannin. The latter therefore is injurious.

As *Aspergillus* converts sugar into oxalic acid, the writers investigated the influence of this acid on nitrification. Their conclusion is negative.

720 **Adsorption of Potassium by the Soil.** — MC CALL A. G.; HILDEBRANDT F. M. and JOHNSTON E. S. (J. Phys. Chem., XX, 51-63, 1916). *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 4, p. 267, London, Feb. 29, 1916.

To ascertain the effect of contact for a short time between a soil and salt solution, and the influence of surface area upon the amount and rate of adsorption, an approximately five hundredth normal solution of potassium chloride was caused to percolate through a sandy loam soil, the potassium in the percolate being estimated colorimetrically. This soil was used in two different states: a) dried and passed through a 2 mm. sieve, and b) very finely ground in a porcelain-lined ball mill for 4 days. The apparatus consisted of a Pasteur-Chamberland filter tube surrounded by a brass jacket to hold the soil, the whole being enclosed in a porcelain-lined filter chamber, into which the solution was poured, and which was fitted with an air-tight cap in connection with an automobile tyre pump. The amount of potassium leached out of the soil samples by pure water was first ascertained: much more was dissolved from (b) than from (a); 20 gr. of (a) was treated with 250 cc. of the potassium chloride solution containing 62 parts per million of potassium, the flow was maintained at a uniform rate, and the percolate was collected in fractions of 50 cc. The amount of adsorbed potassium was then immediately found by leaching with pure water, at the same rate of flow. The amounts of potassium in the first five percolates were, 40, 36, 40, 44, and 59 p. p. m. respectively, and the corresponding amounts retained p. p. m. of dry soil were 58, 124, 181, 226 and 233. The leaching action of water gave 7, 11, 9, 9, 8 p. p. m. of potassium in the fractions. With soil sample (b), it was found very unexpectedly, that the amount of potassium

in the solution was increased and not decreased by its contact with the soil and this increase was only partly accounted for by the solvent action of the solution on the potassium in the soil. Allowing for this correction, a potassium chloride solution containing 78 p. p. m. gave fractional percolates containing 107, 91, 82 and 92 p. p. m. of potassium. By the subsequent leaching action of water, 39, 24, 21, 18, 15 and 18 p. p. m. of potassium were removed in the different fractions. The above case of negative adsorption is probably due to the solvent (water) being adsorbed more rapidly than the solute. Positive adsorption gradually diminishing and changing to negative adsorption was observed by Williams for certain electrolytes in water with blood charcoal, but the above is the first recorded instance of initial negative adsorption.

727 - **Basic Exchange in Soils.** — RICE, F. E. (*J. Phys. Chem.*, 20, 214-227, 1916). *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 8, p. 480. London, April 29, 1916.

Soils (33 grms.) from various parts of New York State were shaken with 100 cc. of normal potassium nitrate solution, allowed to stand over-night and filtered. In portions of the filtrate the hydrogen ions were determined by STØRENSEN'S method, and the lime requirement in pounds of lime per acre was determined by VEITCH'S method, while other portions were used for qualitative tests of the bases present, and titration with fiftieth normal sodium hydroxide solution. It was found that in the case of so-called "acid" soils part of the cation of the salt was absorbed, while an equivalent quantity of bases from the soil was dissolved. The extracts thus obtained showed greater acidity than the original soils. This was attributed to the formation of hydrated aluminium oxide in the hydrolysis, together with equivalent quantities of free acid, and since the latter was strongly ionised while the former was lightly ionised and possibly in a colloidal state the resultant solution was distinctly acid. Water-soluble acid was found in only two samples of acid soils. Basic (as distinguished from "acid" soils) gave up to the salt solution more base than they adsorbed, but this was attributed not to basic exchange, but to solution of excess of the base

728 - **Relation of Carbon bisulphide to Soil Organisms and Plant Growth.** — FRED E. F. (*Agricultural Bacteriologist*, Agricultural Experiment Station of the University of Wisconsin), in *Journal of Agricultural Research*, Vol. VI, No. 1, pp. 1-19, 2 plates. Washington D. C., April 3, 1916.

In previous publications by this and other scientists, data were presented to show the beneficial action of bisulphide of carbon on the soil flora. As this action varies, fresh experiments were undertaken in order to ascertain the factors in these variations. There were studied: 1) the effect of different doses of carbon bisulphide; 2) the effect of carbon bisulphide on different plants; 3) the effect of carbon bisulphide on different soils. Some further experiments were carried out for the purpose of simultaneously studying the effect of carbon bisulphide on higher and lower plant forms. The fresh soil used in these experiments was sieved and potted in 2-gallon jars and the moisture maintained at half saturation. 2 per cent. of commercial carbon bisulphide was poured into small holes in the soil, which were

covered immediately. The changes in the soil flora were determined at regular intervals by plate counts and dilution counts. The formation of ammonia and nitrates was also measured at regular intervals. The plants used were buckwheat, clover, corn (maize), mustard, oats and rape.

These investigations prove that the addition of carbon bisulphide to soil exerts a decided effect on the fauna and flora of the soil. This is characterized by a temporary reduction in the number of micro-organisms. Later, an enormous multiplication of bacteria takes place and an almost parallel increase in production of by-products or soluble nitrogen is noted. The ammonia content seems to follow the curve of bacterial growth and later gives way to larger amounts of nitrate. From the evidence it seems that carbon bisulphide in soil produces an increase in soluble compounds of nitrogen and sulphur.

In Miami soil carbon bisulphide benefited the growth of buckwheat, oats, and mustard. No relation seems to exist between plant stimulation with carbon bisulphide and the form of the soluble nitrogen. In non-acid soils carbon bisulphide is most beneficial to sulphur-loving crops such as mustard. In all of the experiments, except acid soils, mustard showed an increased growth from the use of carbon bisulphide. Carbon bisulphide in peaty soil greatly benefits the growth of red clover. In sand cultures plus soluble plant food carbon bisulphide favors the growth of certain plants.

The data show clearly that carbon bisulphide does not act alike in all soils or toward all crops.

The article concludes with a bibliography of 13 works dealing with this question.

729 - **The Effect of Elemental Sulphur and of Calcium Sulphate on Certain of the Higher and Lower Forms of Plant Life.** — PRZEW. (Agricultural Experiment Station of the University of Wisconsin), in *Journal of Agricultural Research*, Vol. V, No. 16, pp. 771-780, Washington, D. C., 1916.

The problem of sulphur and sulphates in agriculture is still far from being solved, especially as regards their action on micro-organisms. In order to study this phase of the problem, 3 series of experiments were planned: 1) and 2) to note the effect of sulphur and sulphates upon the soil micro-organisms and upon pure cultures of legume bacteria; and 3) to note the effect of sulphur and sulphates on the growth of red clover (*Trifolium pratense*). For the experiments with mixed cultures fresh soil was used as an inoculum. For legume bacteria all materials were sterilised, and the nutrient medium was inoculated with a pure culture of bacteria from the nodules of red clover.

The various experiments show that calcium sulphate added to the soil has no perceptible effect on the total number of bacteria growing on gelatine plates, and does not materially affect the production of ammonia or nitrates (I). Large quantities of elemental sulphur, on the other hand, reduce the total number of bacteria growing on gelatine plates, while the addition

11 See B. Feb. 1910, No. 114.

of 0.05 % of sulphur to the soil increases ammonia formation. Parallel with this increase there is a reduced formation of nitrates, which is probably due to the acidity or toxic effects resulting from oxidation of the sulphur.

Calcium sulphate stimulates the growth of pure cultures of red clover bacteria, both in nutrient solutions and in soil extracts. The increase is the same with 0.01 % as with 0.1 %. The growth of the clover roots is therefore as strongly stimulated by calcium sulphate in a quantity of 0.01 %, as in quantity of 0.1 %. In small proportions calcium sulphate increases the production of red clover, as well as the formation of the nodules, while concentrates of 0.05 to 1 % do not stimulate stronger growth. The application of elemental sulphur to a clayey-sandy soil, both in quantities of 0.01 % and above, stimulates the growth of red clover, though not very much, without perceptibly affecting the growth of the roots or the nodules.

To sum up, according to the above experiments calcium sulphate produces no marked effect on the bacteria usually found present on gelatin plates. Nor does it stimulate the greater growth of the legume bacteria in pure cultures. It does, however, increase the production of red clover, the growth of its roots and the number of their nodules. On the other hand, the addition of sulphur increases ammonia formation, but reduces the total number of soil micro-organisms. It slightly stimulates red-clover production, but has no influence on the growth of its roots and the number of their nodules.

730 - **Factors influencing the Survival of Dried Soil Micro-organisms; Effect of Soil Solution.** — GILTNER W. and LANGWORTHY H. V. (Michigan Agricultural Experiment Station, in *Journal of Agricultural Research*, Vol. V, No. 20, pp. 927-942, Washington, D. C., 1915)

Publications on the above subject mention generally known facts, especially with regard to the survival of the spores, but devote no attention to the effect of various types of soils on the survival of the organisms dried therein. With the object of remedying this deficiency, the present writers undertook a series of experiments for the following purposes:

(1) To determine whether a micro-organism (*Pseudomonas radiculicola*) can be protected by the solution in which it is suspended before being dried in quartz sand. In the first experiment the effect of saline physiological solutions with or without the addition of organic compounds was studied. In a second experiment the effect: (a) of the same solutions; (b) of a culture bouillon; (c) of milk, was compared with that of an extract of loamy garden soil.

(2) To compare the length of life of *Pseudomonas radiculicola* dried in: (a) quartz sand; (b) garden loam.

(3) To compare the changes produced in the numbers and species of micro-organisms when a watery solution of rich garden loam was dried in 5 different kinds of soil: (a) compost; (b) sand; (c) loamy sand; (d) clayey loam; (e) clay.

The following conclusions were reached:

(1) The survival of non-sporogenic bacteria in an air-dried soil is

partly due to the hygroscopic moisture retained by such soil. This is, however, not the only factor in operation, the survival of bacteria in a soil not being directly proportional to the size of its particles and its hygroscopic moisture.

(2) The bacteria under experiment survive drying in rich garden loam longer than in sand.

(3) If, before being subjected to drying in sand, the bacteria are suspended in a watery solution of the said soil, they survive longer than if such suspension were effected in a physiological salt solution.

(4) The watery solution of the said garden soil therefore must contain substances exerting a protective effect on the bacteria dried.

31 — **New Russian Studies of Nitrogen-fixing Bacteria.** — I. OMELIANSKIY V. L. and SOLUNSKOV M. Sur la distribution des bactéries fixatrices d'azote dans les sols russes (On the Distribution of Nitrogen-fixing Bacteria in Russian soils) in *Archives des Sciences biologiques publiées par l'Institut impérial de médecine expérimentale à Petrograd* (French Edition), Vol. XVIII, No. 5, pp. 459-482, 3 plates. Petrograd, 1915. — II. OMELIANSKIY V. L., Fixation de l'azote atmosphérique au moyen des cultures mixtes (Fixation of Atmospheric Nitrogen by Mixed Cultures), *Ibid.*, Vol. XVIII, No. 4, pp. 338-377, 1 plate. Petrograd, 1915. — III. OMELIANSKIY V. L., Sur les rapports entre la fixation de l'azote et la consommation de matières organiques non azotées par les bactéries fixatrices d'azote. (On the Relations between Fixation of Nitrogen and the Consumption of Non-nitrogenous Organic Substances by Nitrogen-fixing Bacteria). *Ibid.*, Vol. XVIII, No. 4, pp. 327-337, 2 fig. Petrograd, 1915. — IV. OMELIANSKIY V. L., Sur la physiologie et la biologie des bactéries fixatrices d'azote (The Physiology and Life History of Nitrogen-fixing Bacteria), *Ibid.*, Vol. XIX, No. 2, pp. 162-268, 1 plate. Petrograd, 1915.

I. *Distribution of Nitrogen-fixing Bacteria in Russian Soils.* M. OMELIANSKIY and M. SOLUNSKOV start out from the principle that the universal occurrence of a given micro-organism with clearly defined chemical functions is one of the most conclusive arguments as to the importance of such micro-organism. They give the results of their enquiries carried out in the General Microbiology Section of the Imperial Institute of Experimental Medicine in Petrograd, on the occurrence of *Clostridium Pasteurianum*, an anaerobic nitrogen-fixing bacterium, and *Azotobacter chroococcum*, an aerobic nitrogen-fixing bacterium, in the soil of the Russian Empire. The investigations were made on soils taken from different depths in 12 localities of European and Asiatic Russia. Besides these, the presence of *Clostridium Pasteurianum* only was studied in 14 samples from other localities of the Empire. The results were as follows:

(1) *Azotobacter* and *Clostridium Pasteurianum* occur very widely in soils of different characters and in the most divergent regions of the Empire. In some few cases only the nitrogen-fixing agent was isolated, for instance *Azotobacter* in the sands of the Kirghese steppes and in the peat soils in the north of European Russia (province of Archangel).

(2) The races of *Azotobacter* and *Clostridium Pasteurianum* isolated in the enquiries are clearly morphologically distinct, especially those of *Clostridium Pasteurianum*.

(3) In these experiments, the two bacteria studied exhibited a different fixing power, weaker in *Azotobacter* than in *Clostridium Pasteurianum*,

but the figures were very close (1 to 3 mgms. of nitrogen per gram of sugar decomposed).

II. *Fixation of Atmospheric Nitrogen by Mixed Cultures.* — The work of different investigators has demonstrated that in mixed cultures nitrogen-fixing is more considerable than in the case of pure cultures. On the basis of this fact and assuming that mixed cultures approximate more closely to the natural life conditions of nitrogen-fixing bacteria, M. OMELIAN-SKIY studied the fixation of nitrogen in cultures of a large number of races of *Azotobacter* and *Clostridium Pasteurianum* isolated from different Russian soils, associating with them many other micro-organisms usually accompanying them in the soil. From his many experiments he concludes that :

(1) The study of the biochemical reactions by means of which the bacteria in mixed cultures fix atmospheric nitrogen is interesting in several respects, as it brings out clearly the various aspects of the natural process occurring under conditions of combined action of the different organisms.

(2) The organisms acting in combination with the nitrogen-fixing bacteria in upper soil strata are very numerous and they play an extremely important part in the life of the soil.

(3) The synergetic activity of nitrogen-fixing and accompanying microbes is, both in laboratory experiments and under natural conditions (cultivable stratum of the soil), of a different character according to the properties of the species taking part in the process and their environment. In other cases the function of the satellite organism seems to consist in fixing the oxygen of the air and in creating the anaerobic environment (for *Clostridium Pasteurianum*). The species added to the cultures of nitrogen-fixing microbes sometimes supply the compounds of carbon needed for the process of fixing nitrogen as energetic substance. In the case of the combination : *Azotobacter* + *Clostridium Pasteurianum*, the function of the former is not confined to fixing the oxygen of the air only, and consequently to creating an anaerobic environment for the *Clostridium*, but this combination is also useful inasmuch as it destroys the injurious products of dissimilation created by the second (chiefly butyric acid) and maintains the action of the environment (*Azotobacter* is alkaligenic and the *Clostridium* acidogenic).

(4) The satellite species may also unfavourably affect the nitrogen-fixing microbe, either through products of assimilation or by consumption of the carbon compounds needed by this microbe for nitrogen-fixing. The energetic fixation of oxygen by the satellite aerobic species creates conditions favourable to the development of *Clostridium Pasteurianum*, but at the same time hinders the growth of the *Azotobacter*, which is necessarily aerobic.

(5) The form endowed with the maximum vitality and at the same time the most common form in which combination of the nitrogen-fixing organisms takes place in the upper soil strata is that of symbiosis between the aerobic and anaerobic nitrogen fixers, principally between *Azotobacter* and *Clostridium Pasteurianum*. In spite of the opposite properties of the

wo species, their synergetic activity in the upper strata of the soil results in a harmonious mutual development producing the maximum economy in consumption of energetic substances.

III. *Relations between the Fixation of Nitrogen and the Consumption of Non-nitrogenous Organic Substances by the Nitrogen-fixing Bacteria.* — For these investigations, M. OMELIANSKIJ used an artificial mixture of *Azotobacter chroococcum*, an aerobic fixer, isolated from the soil of the Institute, and *Clostridium Pasteurianum*, an anaerobic fixer, isolated from the soils of a kitchen garden in the province of Volhynia. The use of this mixed cultivation was for the same object as in the work last mentioned, a closer approximation to the actual conditions under which the simultaneous activity of the nitrogen-fixing microbes takes place in the soil.

The nutritive medium of this culture was composed as follows per 100 cc.: 80 cc. of drinking water, 20 cc. of linseed extract 5 % strength, 2 grams of dextrose, 0.1 gram of potassium phosphate, 0.05 g magnesium sulphate, 0.5 gram calcium carbonate. Dextrose was chosen as a non-nitrogenous substance because it is suitable as a food both for *Azotobacter* and *Clostridium*.

On the 6th April 1911, this food mixture was poured into 27 Vinogradskij flasks at the rate of 100 cubic centimetres to each; 3 flasks were then left as controls in order to ascertain the quantity of nitrogen and sugar, and 24 were sown with the mixture of the two bacteria. During these experiments, which lasted 6 weeks, the flasks were maintained at a temperature of 21°-22° C. Every 5 days, 3 flasks were taken, in order to determine sugar in one by the Bertrand method, and nitrogen in the two others by the Kjeldahl method.

The principal results of the chemical analyses are grouped in the appended diagram, which brings out clearly the most interesting facts ascertained by the researches, namely, the existence of a close relation between the process of assimilation and that of dissassimilation in the cell, which leads to its organic growth. In this diagram, the ordinates exhibit the quantity of nitrogen fixed in milligrams and that of sugar decomposed in grams. The abscissae indicate the duration of the experiments in days.

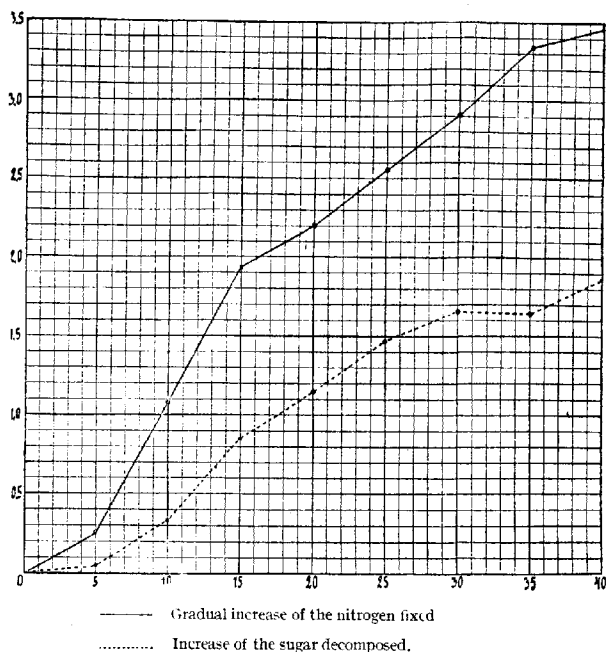
On closer examination of the results obtained, it may be said that the process of fixation of nitrogen ran its course uninterruptedly until the available energetic substance was consumed.

The quantity of nitrogen fixed is relatively small (1.735 mgrms of nitrogen per gram of sugar decomposed), which must be put down to the low degree of activity of the bacterial strains employed in the experiments.

The curves of nitrogen fixed and sugar decomposed are generally parallel. They show a continuous increase throughout the experiment, the maximum rise taking place in the period between the 5th and 15th day.

A comparison between the productivity of the work of the bacteria at different periods (of 5 days each) of their life presents some interest. Completing the data of the diagram, it is found that the process of nitrogen fixation is at its best in the first period. The absolute quantity (0.24 mg) of the nitrogen fixed during the first 5 days is insignificant, but relatively

Curves showing the Fixation of Nitrogen and Decomposition of Sugar in mixed cultures of *Azotobacter chroococcum*, and *Clostridium Pasteurianum*.



to the quantity of sugar consumed, it represents the greatest degree of efficiency. The efficiency of the bacteria declines rapidly during the three following periods, after which, during the final period, it remains at nearly the same level. It may be said therefore that during the first periods of growth of the bacteria in question in the non-nitrogenous medium, that is to say, when the cells of the nitrogen fixers multiply energetically, their work is most efficient. The impression of the low efficiency of the work of these microbes gained from examining the ratio $\frac{+N}{-C}$ at the close of the experiment must be due to the depressing influence resulting from the process being in its last stages.

IV. *Physiology and Biology of Nitrogen-fixing Bacteria*.—M. OMELIANSKIJ has endeavoured to make a digest of the large amount of information contained in the literature, not systematised hitherto, in relation to the physiology and biology of *Azotobacter chroococcum*, supplementing them by his own researches. He deals with the following questions: methods of accumula-

ion of *Azotobacter* in cultures (selected cultures); methods employed to isolate it; its growth in different solid and liquid nutritive media; influence of temperature, aeration, etc. He devotes his chief attention to the problem of the fixation of free atmospheric nitrogen, and in particular the conditions assuring the highest efficiency of the species under study, with reference not only to the absolute quantity of nitrogen fixed, but also to the quantity of non-nitrogenous substances oxydised.

32 — **Method for the Estimation of Hygroscopic Moisture in Soils.** — HAIGH W. D. (Sci. Proc. Roy. Dublin Soc., XIV, 529-534, 1915). *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 1, p. 266, London, Feb. 29, 1916.

The ordinary method of determining the hygroscopic moisture (*i. e.*, the water left after air-drying) in a soil by heating it at about 100° C. for 12-24 hours, gives high results owing to the loss of volatile matter other than water. The method now proposed, which gives lower but strictly consistent results, consists in shaking the soil with powdered calcium carbide and measuring the acetylene evolved in a nitrometer. The mixing vessel is a thick glass tube shaped like a Kjeldahl flask but with a bent neck; a small test tube fits into the neck but cannot pass the bend. The carbide (about 3 times the weight of soil) is first placed in the bulb: the small tube with the soil is inserted in the upper, bent portion which is kept horizontal; and then the flexible joint is connected to the nitrometer. The tube is tilted to empty the soil on to the carbide, and the mixture is shaken; the acetylene comes off rapidly and can be measured within a few minutes. A blank experiment should be performed with ignited sand and a known weight of water. As found by other workers, the volume of acetylene liberated from 0.018 grms. of water measured 10.5 cc. instead of the theoretical 11.2 cc. The combined water contained in the hydrated silicates of a soil is practically unaffected by the carbide.

33 — **The Reaction of Soil and Measurements of Hydrogen-Ion Concentration.** — GILLESPIE L. J. C. (J. Washington Acad. Sc., VI, 7-16, 1916). *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 4, p. 266, London, Feb. 29, 1916.

The reaction of a soil should be studied from the standpoints of quantity of acid substance, and of intensity of the acidity. The amount of lime, or other neutralising materials required to correct acidity, depends upon the first, but probably the characteristic effects of acidity upon fertility are more clearly correlated with the latter, which can only be measured by determining the hydrogen-ion concentration. Twenty-two soils of seven distinct types were investigated from this point of view, both by the electrometric and colorimetric methods. In both of these the soil was air-dried, passed through a coarse sieve, and then mixed with twice its weight of water. The electrolytic vessel, which was shaken continuously throughout the determination, contained a platinum electrode coated with palladium, as a means for filling the space above the suspended soil with pure hydrogen, and at its base a stop-cock to connect the liquid with a saturated solution of potassium chloride. The difference of potential between the platinum and a saturated potassium chloride calomel electrode was found by means of a very sensitive voltmeter.

In the colorimetric method, the liquid was first centrifuged, and after the indicator solution had been added, the colour produced was measured by comparison with that of a solution of known hydrogen-ion concentration. The indicators used were methyl red, the sodium salt of phenolsulphone-phthalein, phenolphthalein, the recently prepared tetrabromophenol sulphone-phthalein, dipropyl red, and bromothymol sulphone-phthalein. Each soil sample was tested with two of these indicators. The results were in close agreement with one another, and with the electrometric determination. The hydrogen-ion concentration expressed as the hydrogen-ion exponent of SØRENSEN, varied from 4.4 to 8.6, the exponent 7 indicating neutrality. The application of the colorimetric method to soils under field conditions is now being investigated.

734 - **Relation of Green Manures to the Failure of Certain Seedlings.**—FRED E. I (Agricultural Bacteriologist, Agricultural Experiment Station of the University of Wisconsin), in *Journal of Agricultural Science*, Vol. V, No. 25, pp. 1161-1176, 2 plates. Washington, D. C., March 20, 1916.

In a previous report it had been shown that if green manures are turned under and cotton planted immediately, a decrease in germination may result, while if the operation is repeated three weeks later germination is perfectly normal.

With a view to studying this phenomenon, fresh experiments in jar and in the field were made with green manures of crimson clover, in the proportion of about 1 per cent. of the soil, and with different kinds of seeds. The effect of some products of decomposition, heat, bacteria and fungi was also studied.

The investigations as a whole confirmed the injurious action of green manure on seed germination. It appears to be due to some parasitic fungus (*Rhizoctonia* sp.). During the first period of decomposition of the green manure, many fungi develop, some of them having a destructive action on germs. Oil seeds in particular are very liable to be injured. Starchy seeds on the contrary are highly resistant. Cotton and soya seeds are extremely sensitive to green manure. The germination of flax, pea-nuts, hemp, mustard and clover is likewise reduced, though to a less extent, by the presence of decomposing vegetable tissue. The germination of buckwheat, corn, oats and wheat is not affected by green manure.

The injurious action of green manure on oil seeds is confined mostly to the first stages of decomposition. The experiments undertaken appeared to show that two weeks after the green manure has been turned in, it no longer has any serious harmful effect on the germination of oil seed. The addition of small quantities of lime appears to increase the injury to germination, the greater or less rapidity of the latter to some extent influencing the amount of such injury. Thus slow germination is marked by a high percentage of diseased seedlings.

Appended is a bibliography of 21 works relating to the question.

735 - **Hygienic, Scientific and Economic Disposal of Human Excreta.** — GARRIGOU F., in: I. *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 162, No. 17, pp. 649-651. Paris, April 25, 1916. — II. *Revue d'Informations du Ministère de l'Agriculture*, XX1st Year, No. 18, pp. 10-11. Paris, May 2, 1916.

Various methods of sewage treatment have been proposed based on distillation of the sewage in the presence of lime, with the object of liberating ammonia, which is afterwards transformed into sulphate. The author has devised a method of sewage treatment dispensing with distillation and almost all the complicated apparatus it involves. The following is a description of it:

The solid and liquid matter are treated separately.

A) The operations on the *liquid matter* are based on the double decomposition taking place between sulphate of lime and carbonate of ammonia, and resulting in the formation of carbonate of lime and sulphate of ammonia.

The urine which has fermented sufficiently for the conversion of the urea into ammonium carbonate is emptied into a vat with water-tight lid. Finely powdered calcium sulphate (gypsum) crude or dehydrated is added, and the mixture is stirred up frequently. The lime is precipitated in the form of insoluble calcium carbonate, while the ammonia passes into the state of soluble ammonium sulphate. The liquid is allowed to settle. The calcium carbonate formed collects at the bottom of the vat, while the ammonium sulphate remains in the liquid which can be racked off.

This liquid can be concentrated in iron basins until the sulphate crystallises. It can also be absorbed by ash, sawdust, or completely dehydrated gypsum, and kept in that state until used. It gives off no disagreeable smell.

The sulphate of ammonia thus produced is very low in cost, being obtained from an ammonium carbonate derived from the urea in the urine, with the aid of sulphate of lime or gypsum which is very cheap.

In addition, the precipitated calcium carbonate, which carries with it mechanically considerable quantities of organic matter from the liquid treated, forms a manure of high market value owing to its content of organic nitrogen and other fertilising substances.

In case the whole of the ammonium carbonate in the urine has not been completely converted into sulphate by the calcium sulphate, the remainder can, by the addition of acids, be converted into nitrate or other inodorous ammonia salts, which add still more to the value of the liquid containing the sulphate of ammonia.

This mode of treatment of the liquid sewage can, owing to its simplicity, be used not only in large cities but also in small towns or villages and even on farms.

B) As regards the *solid matter*, it is separated from the liquid by settling. On reaching the works the sewage is emptied into covered and tightly closed settling basins in which the solid matter is deposited. The liquid is, after clarification, delivered into the fermentation basins, where it undergoes the operations described above.

The solid matter deposited at the bottom of the settling basins in the

form of thick mud is passed through the press filter if necessary and then put into autoclaves and heated to a temperature of 140° to 150° C. This temperature is maintained for 15 minutes, after which the steam exhaust of the autoclave is opened, and the steam passing out carries with it the ammonia salts. It passes through cool condensing coils, and is then delivered into vats containing sulphuric or nitric acid for the production of inodorous ammonium sulphate or nitrate.

In the autoclave there remains a perfectly dry, fine powder, ready for putting up in sacks, very rich in fertilising substances and completely sterilised. The condensation coils may, if necessary, be arranged at the bottom of the settling basins, so as to utilise the waste heat to increase the fermentation of the mud and produce the maximum quantity of ammonium carbonate.

The method of operation is thoroughly practical and hygienic. It ensures the maximum yield and does away with all the disadvantages of the ordinary methods of sewage disposal. Huge distillation appliances, unhealthy and repulsive smells, the expense of sterilising mixtures to be added to the sewage, are all done away with, while there is a saving in supplies of every kind, labour, plant and fuel, together with an increase in the agricultural value of the manure produced.

730 - The Solubility of "Fluorspar Slag" and Mineral Phosphates in Citric Acid. --

I. ROBERTSON G. S. The Influence of Fluorspar on the Solubility of Basic Slag in Citric Acid. — *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 4, pp. 216-217. London, 1916. — II. *Ibid.* The Solubility of Mineral Phosphates in Citric Acid. Part II (1). — *Ibid.*, pp. 217-220.

I. — During the past few years British steel manufacturers, particularly those using the basic open hearth process, have been introducing fluorspar into the furnace. Fluorspar produces a much more fusible slag and greater quantities of lime can therefore be added without making the slag too thick. Many thousands of tons of this "fluorspar slag" are produced annually and form a waste product; one Teeside firm alone produces over 100 000 tons per annum; certain firms even pay a few pence per ton to have the slag carried out to sea.

The peculiarity of basic slag produced by the use of fluorspar is that the solubility of the phosphate, according to the citric acid test, varies from 20-50 % instead of from 70-90 %.

Original "fluorspar slags," artificially prepared "fluorspar slags" and Tunisian rock phosphate were subjected to five consecutive half-hour extractions with 500 cc. of 2 per cent citric acid. The results clearly show that the citric acid test gives no true idea of the solubility of the phosphate in "fluorspar slags" and affords no guide to its value to the plant.

The use of fluorspar in the manufacture of steel by the open hearth process results in the production of a phosphatic slag with low citric solubility.

Nevertheless the slag is completely soluble in citric acid if sufficient

time is spent on the extraction. The phosphate or phosphates which the slag contains do not appear to be in combination with silica and they seem to bear a very close resemblance to those contained in mineral phosphates.

At the present time there is a very big demand for phosphatic manures, and if temporary difficulties, such as a lack of railway facilities and shortage of bags, could be to some extent mitigated there is no reason why these low citric soluble basic slags should not be placed on the agricultural market at a tempting price (1).

II. — The citric solubility of several classes of mineral phosphates has been determined and also the effect, upon the solubility of the phosphate, of fineness of grinding and calcining.

Citric Solubility of Rock Phosphates.

Phosphoric acid dissolved.	Makatea refuses 1 mm. sieve.	Makatea passing " 100 " sieve.	Calcined Makatea passing " 100 " sieve.	Florida land pebble refuses " 30 " sieve.	Florida land pebble passing " 100 " sieve.	Calcined Florida land pebble passing " 100 " sieve.	Algerian passing " 100 " sieve.	Calcined Algerian passing " 100 " sieve.	Cafsa passing " 100 " sieve.	Calcined Cafsa passing " 100 " sieve.	Belgian passing " 100 " sieve.	Calcined Belgian passing " 100 " sieve.
	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent	per cent
1st extraction . .	3.93	9.25	6.58	4.00	6.18	6.01	6.65	3.33	10.15	5.20	1.95	7.80
2nd extraction . .	3.66	8.26	6.32	3.81	5.83	6.77	6.48	4.36	8.18	6.55	5.65	6.98
3rd extraction . .	3.47	7.54	5.55	3.63	5.46	6.63	5.35	3.78	5.60	5.77	5.78	6.20
4th extraction . .	3.28	6.03	4.63	3.23	5.14	5.41	4.00	3.10	1.93	1.19	4.95	4.53
5th extraction . .	2.91	4.22	3.79	3.00	4.31	3.88	2.47	2.29	—	2.29	1.99	3.08
Total extract . .	17.25	35.30	26.87	17.67	20.92	28.78	25.45	16.86	25.86	24.30	30.32	40.52
Actual total . .	38.00	38.24	38.24	33.27	31.50	31.50	27.27	27.27	25.35	25.35	19.80	50.55

* Free lime removed by sugar solution.

The results undoubtedly show that mineral phosphates are completely soluble in 2 % citric acid if a sufficient number of extracts are made. In the majority of the rock phosphates examined five extracts removed 90-100 % of the phosphoric acid present.

Even a small amount of free lime or calcium carbonate decreases substantially the solubility of mineral phosphates as judged by the citric acid test. When a large amount of calcium carbonate or free lime is present, the citric acid test, as commonly practised, is a test for lime and not for phosphates. It is important in this respect to distinguish between free lime and calcium carbonate, and lime actually entering into the composi-

(1) See *B.* Aug. 1915, No. 706; also *B.* Oct. 1915, No. 710; *B.* Jan. 1916, No. 117 and *B.* Feb. 1916, No. 149.

(Ed.).

tion of the phosphate. The higher the percentage of lime actually entering into the phosphate compound, the higher the citric solubility of the phosphate.

Fineness of grinding affects the total citric solubility of the mineral phosphates (judged by 5 extracts) to the extent of approximately 10 % decrease for each of the gradients: passes "100", refuses "100", refuses "60" and refuses "30" sieve.

With one exception calcining produces a marked decrease in the citric solubility of mineral phosphates. The longer the calcining continues the more insoluble does the phosphate become.

The results judged as a whole confirm the conclusion of the former investigation (Part I, above quoted), namely, the worthlessness of the citric test as a means of establishing the relative value to the plant of phosphate manures. Rock phosphates are quite as soluble in a 0.25 per cent. hydrochloric acid solution as basic slag, and there is just as much reason in favour of using a weak solution of a mineral acid for a solvent as there is for using a 2 per cent. citric acid solution. According to the writer it would be absurd to consider basic slag as of no agricultural value because it is insoluble in water, and it is equally absurd to condemn mineral phosphates because they are not so soluble in citric acid as basic slag. There can be little doubt that, as a source of phosphoric acid for the plant, rock or mineral phosphates are just as valuable as basic slag.

737 - **Potash in Banana Stalks and Skins.** — ELLIS R. H. — I. Potash in the Banana Stalk. in *Journal of the Society of Chemical Industry*, Vol. XXXV, No. 8, pp. 456-457. London. April 29, 1916. — II. Note on the Presence of Potash in Banana Skins. *Ibid.*, No. 9, p. 521, May 5, 1916.

I. — When making an examination of the banana stalk with a view to the use of its fibre for paper-making, Mr. ELLIS found the juice of the stalk to be markedly alkaline. He therefore made an analysis, and found a large percentage of potash, and practically no soda. Another analysis was made by Mr. Hanley, of the Agricultural Department of Leeds University. The figures of both analyses are reproduced in Table I.

TABLE I. — *Composition of Stalk :*

	ELLIS	Hanley
<i>In original stalk :</i>		
Water	91.60 %	92.70 %
Dried matter	8.40	7.30
Ash	2.40	1.50
Potash	1.14	0.90
<i>In dried matter :</i>		
Ash	29.50	20.50
Potash	13.73	12.35
<i>In the ash :</i>		
Potash	45.00	56.10

The readings of this Table show that the dried matter of the stalk contains as much potash as does kainit.

In the juice of the stalk Mr. Hanley found 0.7 % of potash.

From the results obtained by Mr. Ellis, 1 ton of banana stalks will yield 188 lb. of dried matter containing 13.7 % of potash (K_2O), or 54 lb. of ash containing 47.5 % potash, or 25 lb. of pure potash. Over 4000 stalks are said to come into Leeds every week, having a total weight of 16,000 cwt., representing 1340 lb. (about 12 cwt.) of dried matter as rich in potash as kainit.

In the discussion which followed delivery of the above paper to the Society, stress was laid on the importance of vegetable refuse from the markets as a source of potash, and it was proposed: 1) to set apart the refuse for analysis and treatment; 2) to analyse the ash obtained in refuse destructors, as a large percentage of it came from vegetable produce and consequently contained a quantity of potash.

II. — An analysis of banana skins gave the results contained in Table II.

TABLE II. — *Composition of Skins*

<i>In original skin :</i>	
Water	88.20 %
Dried matter	11.80
Ash	1.77
Potash	1.65
<i>In dried matter :</i>	
Ash	15.00
Potash	9.03
<i>In ash :</i>	
Potash	57.16

These results are of some practical importance for the United Kingdom, which, one year with another, imports 9 million bunches averaging 180 bananas each, the skins of each bunch totalling a weight of 6.8 kg; thus it receives every year 61 235 tons of skins containing 7226 tons of dried matter with 9 % of potash. Besides this, the 9 million stalks weighing 1.8 kg each on the average, or 16 328 tons aggregate supply 1372 tons of dried matter with 13.7 % of potash.

738 — **Waste of Tobacco Ash.** — BURRELL, B. A., in *Chemical News*, Vol. 113, No. 2949, pp. 255-256. London, June 2, 1916.

The fact is recalled that the ash of tobacco, in the various forms in which the latter is smoked, represents on the average 30 % of the burnt leaf and contains 20 % of potash and 5 to 6 % of phosphoric acid. If hotel proprietors and restaurant keepers had tobacco ashes methodically collected, they would be rendering a service to the country in connection with the potash problem, and at the same time making a profit for themselves.

It is found that :

A cigar weighing 106.5 grains will give about 32.3 grains of ash, of which 6.5 grains is potash :

A cigarette weighing 27 grains will give 8.5 grains of ash, of which 1.75 grains is potash;

A pipe holding 25.5 grains of tobacco will give 8 grains of ash with 1.6 grains of potash.

The results of systematic collecting of tobacco ash and unburnt tobacco also show that tobacco ash and unburnt tobacco from:

1) the smoke-room of a club, collected for eight days, weighed 9³ ounces.

2) the lounge of a large hotel, collected for four days, weighed 1¹ ounces.

3) a large restaurant, collected for 10 days, weighed 2 lbs. 8 ozs.

4) a music hall, one tenth part of the auditorium, one performance only, weighed 4 ounces.

The tobacco consumed in the United Kingdom during the financial year 1913-1914 was 98,412,412 lbs.; the cigars imported weighed 1,331,801 lbs. This would give a total consumption of 44,529 tons, which would represent 13,359 tons of ash. Reckoning the latter quantity as kainit with 12.5 per cent. of potash, it would represent 21,376 tons of kainit worth nearly £ 51,000. In the spring of 1915 it was worth nearly three times as much.

739 - **The Question of Sulphate of Ammonia in Russia.** — I. KALENSKIY B., Sulphate of Ammonia and Nitrate of Soda, in *Земледельческая Газета* (The Agricultural Gazette), No. 4 (120), pp. 85-88. Petrograd, 1916. — II. Circular of the Department of Agriculture, in *Подольский Хозяин* (The Agriculture of Podolia), No. 9-10, p. 52. Vinnitza, 1915. — III. Circular of the Agronomic Institute of Moscow, *Ibid.*, No. 11-12 pp. 44-45. Vinnitza, 1915. — IV. MAKRINOV, J. A., New Method of hastening Nitrification, in *Земледельческая Газета*, (The Agricultural Gazette), No. 8 (124), pp. 198-201; No. 9 (125), pp. 224-227. Petrograd, 1916.

I. — The production of sulphate of ammonia in Southern Russia, where this industry is almost entirely concentrated, has during the last few years increased parallel with the development of the coke industry in the basin of the Donetz:

In 1911, the production was	191 metric tons
In 1912 " " "	4 013 " "
In 1913 " " "	13 808 " "
In 1914 " " "	17 176 " "

In 1915, this production reached 16 380 metric tons, and stocks at the end of the year amounted to 24 570 tons. It is anticipated that the production for this year will be 32 760 tons, so that this year Russia will have at its disposal about 57 330 tons of sulphate of ammonia (24 570 tons in stock and 32 760 tons manufactured in 1916).

Before the present war, almost the whole of the sulphate of ammonia was exported. Its high price precluded its use as a fertiliser in Russia. Exportation having been stopped by the war, the price dropped to 29 francs per quintal (220 lbs). Importation of nitrate of soda being also suspended, Rus-

ian agriculture will be able to make use of a considerable part of the sulphate of ammonia. If the prices go down to between 24.5 and 19.5 francs per quintal, the utilisation of this manure even for cereal crops is perfectly certain, according to the Agronomic Institute of Moscow.

M. KALINSKIJ, in discussing whether Russia can now allow exportation of its sulphate of ammonia or should prohibit it, makes the following calculations for 1916: agriculture requires 27 846 tons; industry 16 380 tons and 4 914 tons must be kept in stock; making in all 49 140 tons. The quantity available for export would therefore be about 8 190 tons. The forecasts of consumption of sulphate of ammonia in Russia are based on that of nitrate of soda, which according to private but reliable data, was about 24 570 tons, distributed as follows (before the war):

Poland and Lithuania (except the government of Vilna)	30 %	7 370 tons
Baltic Provinces (and government of Vilna).	25 %	6 145 "
Kiev sugar beet growing region	30 %	7 370 "
Rest of Russia	15 %	3 685 "
	100 %	24 570 tons

II and III. — The problem of the utmost possible utilisation of sulphate of ammonia being of great importance to Russian agriculture, the Department of Agriculture called the attention of farmers, agricultural associations and the zemstvos to the necessity for active propaganda in favour of this fertiliser. The Agronomic Institute of Moscow took steps in the same direction, and emphasised the necessity for collective purchases of sulphate of ammonia by the zemstvos and by agricultural associations. The Department of Agriculture has also instructed Prof. VOLOKINE, Director of the School of Technical Chemistry at Petrograd, to undertake test experiments on the method of Professor MÜNZZ (nitrification of sulphate of ammonia in peat).

IV. — M. MAKINOV deals with this latter question. After briefly reviewing the most recent results of sewage water purification, on the method of "activated" mud, he states that: 1), thanks to the action of the "activated" mud and the continuous passage of air, a very rapid conversion of ammoniacal compounds takes place parallel with a rapid decomposition of the complex organic substances; 2) the action of the "activated" substance and continuous passage of air enable the process of nitrification to be carried on in an isolated and very intense form, which may be utilised for the practical purpose of converting the large stocks of sulphate of ammonia into saltpetre.

10 — **Manuring Tests with the New Nitrogenous Manure "Guanol", in Germany.** — KORN, in *Fühling's landwirtschaftliche Zeitung*, 65th Year, No. 5-6, pp. 145-158. Stuttgart, March 1-15, 1910.

Manuring tests were carried out to ascertain whether the good results given up to now by "Guanol" (treacle residue mixed with peat dust and sown with *Azotobacter*) (I) are not chiefly due to the bacte-

(1) See *B.* December 1915, No. 1257.

(Ed.)

ria contained in the peat dust. In order to test the fertilising power of the peat dust, it was used in the place of "Guanol" in 2 series of experiments, and in a third it was replaced by nitrate of soda with a view to comparing the effects of the two forms of nitrogen. A trial was also made with "Guanol" sterilised at 100° C. to study the behaviour of the bacteria.

The manure employed contained not more than 1.6 grams of betain per 100 gms. of dried matter, so that 88 % of the betain had been converted by the bacteria at the time of manufacture. It was free from superphosphate, and contained : 48.3 % of dry matter, 3.77 % of nitrogen.

The tests were made with buckwheat, vetches, oats, beet, etc., in pots manured with quantities corresponding respectively to 364,607 and 1215 lbs per acre.

The tabulated results show that the peat dust added to treacle lees slightly reduces the fertilising power of the manure. The nitrogen in the peat exerts no action, the nitrogen of the lees being alone active.

Sterilised "Guanol" gives the same yield as when unsterilised, which proves that the bacteria in "Guanol" have no specific influence on the growth of the plant, at any rate where the soil is rich enough in humus. These experiments will be repeated in soils poor in organic matter. Possibly too the sterilisation was not complete enough to destroy all the bacteria of "Guanol".

In the 3 series where a dressing was applied in the proportion of 364,607 and 1215 lbs of "Guanol" per acre, an increase in yield was obtained proportional to the increased quantity of manure. The nitrogen in the "Guanol" however does not act so well as the nitrogen in nitrate of soda, being present in slightly less assimilable forms.

The researches of the writer into the nitrification of "Guanol" showed that at the end of 8 weeks 30.04 % of the nitrogen of "Guanol" was converted into nitric acid. The nitrogen of nitrate of soda is more easily conveyed into the subsoil by water than that of "Guanol". These enquiries also proved that the specific bacteria of "Guanol" do not promote ammonification or nitrification to any great extent.

Other manuring tests undertaken on grass-lands, grain crops, beets, etc., are not yet completed.

741 - **Studies on the Root System of Plants, in Reference to Selection and Drought Resistance.** — MODESTOV A. P.: I. Differences in the Dimensions of the Root System in different Types of Cultivated Plants, in *Корневая система травянистых растений* (Root System of Cultivated Plants), Part I, pp. 11-44 + 2 tables + 3 plates. Moscow, 1915. — II. Depth reached by Roots under normal Conditions of Growth. *Ibid.*, pp. 46-80 + 14 tables and diagrams. — III. Contribution to the Study of the Root System of Flax. *Ibid.*, pp. 101-118 + 1 table + 1 diagram.

Remarkably little study having been devoted to the underground portions of plants as compared with the parts above ground, the writer undertook a series of methodical investigations of the root system of herbaceous plants, cultivated and wild, in the laboratories and experimental Stations of the Agronomic Institute of Moscow, with the assistance of the Department of Agriculture. The starting point in these enquiries was the fact.

published by the researches of DERÉRAIN, MONVOISIN and KOSOROTOV, that there is a relation between the depth to which plants extend their roots and their resistance to drought. Assuming, therefore, within the limitations of a given species, the plants most resistant to drought are those which possess among other things a root system carried to a greater depth, stress is laid on the need for the following:

- 1) Statistical investigations of the depth reached by the roots of plants, cultivated and wild, of interest to agriculture;
- 2) Investigations into the "metric differences" (i. e. in length and weight) of the root system of the different species and varieties of cultivated plants.
- 3) Investigations into the fixation and the increase by selection of the power of deep root growth.

INVESTIGATIONS INTO THE ROOT SYSTEM OF OATS, WHEAT, FLAX AND PEAS. — These were carried out in 1914, in wooden boxes of 2 different sizes: (1) big boxes with 0.162 square metres base area (0.18×0.09 m.) and 0.77 m. in height, used for plants which were brought to maturity; (2) Small boxes (0.162 sq. metres base area and 0.88 m. height) for the plants removed in the 1st phase of vegetation. The soil was taken from the upper strata of the fields of the Institute. The roots were washed by a jet of water delivered by a pump, and afterwards numbered and straightway put into formalin where they remained until the winter, when they were dried and studied.

The plants taken out of the formalin were washed with water to remove any disagreeable smell, afterwards dried on cardboard, and their aerial and underground parts were then measured and weighed separately or each box. The roots for successive soil layers of 25 cm were also measured, in order to determine the amount of roots in each layer. The resulting data were divided by the number of plants in each box, and this result multiplied by 100, so as to reduce all measurements to one unit, the weight of 100 individuals. The measurements of the length of the aerial and underground parts were alone taken in calculating the maximum, but they are sufficient in view of the preliminary nature of the investigations.

At the beginning of June there were sown: 10 varieties of oats, 8 of spring wheat, 4 of flax and 3 of peas; for each variety 4 boxes were used, 2 large and 2 small, so as to have 100 tests in all. The seeds were taken exclusively from the *pure lines* obtained at the selection Station of the Agronomic Institute of Moscow, because the preliminary studies carried out with commercial oat seeds had given very divergent results as regards downward growth of the root system. In this connection mention may be made of the tests in the open field carried out by the writer in 1915, with pure lines of flax, at the flax selection Station. The depths of the roots for a given line was studied in a considerable number of individuals (100) and over an area of some square metres; it was found that the maximum depth and spread of the roots in the different soil strata was everywhere the same; the maximum depth of the roots ranged from 44 to 53 cm. between one plot and another. In other words, tests have shown that there is a

synchronal constancy in the downward growth of the root system in individuals of the same pure line (of flax).

The enquiries of the writer into the length and weight of the root systems of oats, wheat and flax establish a *clear and essential difference between the length (and weight) in different forms of oats, spring wheat and flax.*

Table I summarises the most important results of the investigation in relation to oats.

The difference between root-length in the different varieties of oat therefore varies greatly, with a maximum of about 1 metre (186.0-101.0 = 85 cm). Then, on comparing the root-lengths with the time of ripening, MODESTOV notes an interesting fact: the longer the roots, the greater the time required for ripening. In other words, the length of the root is proportional to the length of life of the plant. The author explains this phenomenon by saying that early varieties develop during the summer

TABLE I. — *Results of Investigations into the Root System of Oats.*

Numbers of varieties	Length of Roots	Total weight of underground parts of 100 plants	Name of variety from which the pure line was selected out	Ripening
A-337 I.	186 cm	45.56 g	« Gudun » (<i>Avena diffusa</i> var. <i>brunnea</i>)	Late
A-305 I.	178.5	70.85	« Ghigautskij rasviesistij » (<i>A. orientalis</i> var. <i>flava</i>)	Medium late
A-331 C.	170	49.40	« Bielanka » (<i>A. diffusa</i> var. <i>mutica</i>)	Medium
A-329 C.	156	40.73	« Khersonskij Rukhlik » (<i>A. orientalis</i> var. <i>obtusata</i>)	Fairly early
A-4020	150	53.20	« New Market » (<i>A. diffusa</i> var. <i>trisperma</i>)	Medium
C-4160	138	97.65	« Scotch Angus » (<i>A. diffusa</i> var. <i>mutica</i>)	Medium late
A-317 C.	137	35.54	Australian Oat (<i>A. diffusa</i> var. <i>aristata</i>)	Early
A-4114 C.	101	29.90	Nemertchansk Oat (<i>A. diffusa</i> var. <i>mutica</i>)	Very early

period when the moisture has not yet passed through the deeper strata of the soil, and the roots, being able to find an adequate quantity of it, need not lengthen out. This property, peculiar to early varieties (short-root system), has been fixed by heredity and asserted itself in the cultivations in boxes, i. e. in an environment different from the natural one. In the varieties which ripen later, things happen differently: the plants develop in the period when the moisture has already traversed the deepest strata.

and they are compelled to push out their roots in order to get at it. In this case again the peculiar property of the variety (long-root system) has been fixed by heredity and asserted itself in the trial cultivations.

In addition to the length of roots, there were also studied: the total weight of the plant, the weight of the overground and underground parts separately, the distribution of the root stock in the different strata of the soil. As regards the weight, it is found that the length of the root system is not proportional to its total weight (see Table 1) and that, in the majority of cases, the roots, when increasing in length, show a relative reduction in weight. With respect to the distribution of the roots in the different layers (25 cm each) it varies greatly (as stated above) according to the variety. In comparing the different varieties, however, it was found that No. 305 for instance has long roots which are more abundant in the tilled stratum of the soil than those of another kind with long roots, a fact which must unquestionably be of very great importance.

The studies of the other plants, spring wheat, flax and peas, as regards difference of root lengths in the different varieties, confirmed the results obtained with oats, which will probably also hold good for other cultivated plants. For instance, *Triticum vulgare* var. *ferrugineum* No. III has roots 60 cm in length, while those of *Triticum dicoccum* var. *farrum* attain 182 cm. The studies of flax were repeated in 1915 in boxes (they were unsuccessful owing to the hail) and in the field. They bore on: (1) the "metric differences" of the root system in the different pure lines of the plant; (2) the constancy of depth of roots within the limits of the pure line; (3) the influence of different soils and water (water cultures) on the growth of the root system; (4) the influence of moisture on the development of the root; (5) the development of the root at different vegetative periods; (6) the daily growth of the roots; (7) the influence of the depth of seed-planting on the development of the roots; (8) the root system of the principal weeds in flax fields; (9) the stereometric distribution of the roots in the soil. The most important results are as follows:

Flax grown for fibre generally has a weaker and shallower root system than that grown for seed; if the root of the second kind reaches a depth of 70 cm, that of the first does not exceed 40-57 cm. Moreover, the roots of the seed flax are more robust, coarser and closer, a fact explained by the southern origin of this plant, which endeavours to adapt its roots to an inadequate water supply. As regards root development at different periods of vegetation, 3 periods have been distinguished: (1) the initial period, when the flax plantlet has only 10 to 12 leaves; in this period the roots reach down to a depth of 21 cm., maintaining a vertical direction; the distribution of the roots in the different layers of soil is almost uniform; (2) in the 2nd period, the beginning of anthesis, the roots reach 52 cm, and the uniformity of their distribution in the different layers disappears, the bulk of the roots lying within the limits of 20 cm, representing the depth of the first period; beyond the second decimetre a considerable reduction in the mass of roots is observed, only the few main roots with little subdivision being found; (3) in the 3rd period, the end of anthesis, the roots reach a depth of 65 cm

and the character of the root system is the same as in the preceding period. The growth of the roots continued after the end of anthesis (when that the parts above ground had ceased) as was ascertained from the observations of daily development of the root system by means of "observation boxes" fitted with a glass wall. In the roots of flax there is a characteristic winding observed in all the periods of life of the plant. The influence of the depth of the seeds on the development of the root system of flax was not found so clear and decisive as in the case of oats, but differences do exist and must be taken into account in the researches.

STUDIES OF ROOT LENGTH UNDER NATURAL CONDITIONS OF DEVELOPMENT. — After reviewing the results arrived at by different investigators of the root system, with a view to co-ordinating them, the writer described his own experiments carried out on a plot of the experimental field of the Agronomic Institute of Moscow. He adopted the method of DEHÉRAE: cultivation on inclined planes, modifying and completing it. He carried out cultivation: (1) on a natural soil profile by digging a trench 281.6 cm. wide, and 176 cm. deep, with bottom rising gradually towards the surface of the field so that the plants were not on banked-up soil, as at Grignon, but at field level: (2) cultivation on inclined planes, utilising for this purpose the embanking work carried out 40 years ago for water-regulation purposes. The length of the roots was measured at 3 different times, namely: 1) germination, 2) flowering, 3) fructification. The results are summarised in Table II, which also indicates the differences in the length of the roots in successive periods in order to bring out more clearly the behaviour of the root system of each plant.

On analysing the data of Table II, it is seen that, in their first period of life, the plants under investigation had already developed their root system to such an extent as to penetrate deeper layers than those subjected to ordinary tillage.

Starting from the idea of aerial vegetative levels, the writer gives the following scheme of underground vegetative levels.

The first level, down to 44 cm. depth from the surface, comprises the root system of short-rooted plants, chiefly weeds, annual or biennial, the typical representatives of which are, for instance: *Capsella Bursa-pastoris*, *Viola tricolor*, *Thlaspi arvense* and *Berleroa incana*; among cultivated plants, buckwheat belongs to this group.

The second level (between 44 and 88 cm. depth) is occupied by the root ends of short-rooted cultivated plants, for instance: *Sinapis*, *Linum*, *Vicia sativa*, *Pisum arvense*, etc.

The third level (88, 139, 174 cm.) comprises the root ends of long-rooted cultivated plants: *Vicia villosa*, *Panicum miliaceum*, *Avena sativa* and *Solanum tuberosum*, etc.

Next there is a fourth level, comprising only the root ends of long-rooted wild herbaceous plants, as for instance: *Vicia Cracca*, *Potentilla arguta*, *Tanacetum vulgare*, etc.

Finally, the deepest level found lies between 264 and 352 cm.; it com-

TABLE II. — *Length of Roots at different Periods of Vegetation.*

Name of plant	1st period:	2nd period:	3rd period:	Differences	
	Ger- mination	Flowering	Fructi- fication	between the 2nd and the 1st period	between the 3rd and 2nd period
A. — Cultivtn. on natural profile :					
1. <i>Avena sativa</i>	79.2 cm.	132.0 cm.	140.8 cm.	52.8 cm.	8.8 cm.
2. <i>Linum usitatissimum</i> , . . .	35.2	52.8	70.4	17.6	17.6
3. <i>Vicia sativa</i> ,	26.4	88.0	88.0	61.6	0.0
4. <i>Raphanus Raphanistrum</i>	13.2	30.8	35.2	17.6	4.4
5. <i>Chenopodium album</i> . . .	26.4	30.8	35.2	4.4	4.4
B. — Cultivtn. on embankment :					
6. <i>Avena sativa</i>	52.8	92.4	127.6	39.6	35.2
7. <i>Panicum miliaceum</i>	39.6	92.4	unwashed roots	52.8	—
8. <i>Zea mays</i>	30.8	failure			
9. <i>Lupinus albus</i> ,	52.8	left till spring of 1915		—	—
10. <i>Vicia Faba</i> ,	35.2	70.4	unwashed roots	35.2	—
11. <i>Vicia sativa</i>	30.8	79.2	83.6	48.1	4.4
12. <i>Vicia villosa</i>	30.8	74.8	105.5	44.0	30.8
13. <i>Pisum arvense</i>	48.4	74.8	88.0	26.4	13.2
14. <i>Linum usitatissimum</i> . . .	35.2	70.4	74.2	35.2	8.8
15. <i>Sinapis alba</i>	39.6	48.4	70.4	8.8	30.8
16. <i>Polygonum Fagopyrum</i> , . .	26.4	48.4	unwashed roots	22.0	—
17. <i>Helianthus annuus</i> ,	30.8	failures			
18. <i>Cannabis sativa</i> ,	35.2				
19. <i>Solanum tuberosum</i>	61.6	101.2	123.2	39.6	32.0
20. <i>Raphanus Raphanistrum</i>	26.4	52.8	52.8	26.4	0.0
21. <i>Capsella Bursa-pastoris</i> , .	26.4	26.4	39.6	—	13.2
22. <i>Viola tricolor</i>	35.2	35.2	48.4	—	13.2
23. <i>Thlaspi arvense</i>	not yet germinated	35.2	48.4	—	13.2
24. <i>Chenopodium album</i> . . .		44.0	44.0	—	0.0
25. <i>Berteroa incana</i>		48.4	52.8	—	4.4
26. <i>Agrostemma Githago</i> . . .	26.4	66.0	88.0	39.6	22.0
27. <i>Centaurea Cyanus</i>	26.4	66.0	105.6	39.6	39.6

tains the root ends of perennial herbaceous plants as for instance the species of *Rumex*. Lucerne and some lupins also belong to this group.

On comparing the results of growing some cultivated plants (*Avena sativa*, *Vicia sativa* and *Linum usitatissimum*) on a natural profile and on banked up earth, and considering that the compactness of the soil in these two cases must be different, the Author is of opinion that, though it cannot be maintained that the compactness of the soil makes no difference to the roots, it is impossible to share the prevailing view according to which roots should penetrate deeper in less compact soils. He does not however wish to draw an *a priori* conclusion from this fact before making thorough and conclusive investigations. He confines himself to recalling what was said by HENSEN as to the importance of the tunnels left by earth-worms for the extension of roots, and he adds that a similar function is also served by the channels formed by the roots of dead plants. That is why living roots can penetrate even compact soils fairly easily. One might, he says, draw a conclusion which seems a paradox at first sight, namely that deep-rooted perennial weeds, so injurious to the farmer, may at the same time be useful in paving the way for the roots of cultivated plants, which, by penetrating deeper, are sure of success in struggling against drought, and best utilise the nutritive substances of the soil.

A special chapter contains a Bibliography of the subject (552 works); it will be completed later.

742 - **Changes in the Chemical Composition of Rye Seed through the Action of some Forms of *Fusarium*.** — РОМАНСКИЙ А. in *Министерство Земледелия, Бороны, Микологии и Фитопатологии Ученого Комитета. Материалы по Микологии и Фитопатологии России*. Ministry of Agriculture, Office of Mycology and Pathology of the Scientific Committee. Matter relating to Mycology and Plant Diseases. Part 4, pp. 77-106. Petrograd, 1915.

The initiative of continuation of the investigations relating to "pianij khlieb" ("intoxicating bread") the intoxication being caused by the products of alteration of the grain by *Fusarium*) is due to A. A. JATCHEVSKIJ. Director of the Office of Mycology, who has put forward the hypothesis that not only *Fusarium roseum*, but all forms of *Fusarium* similar both from the morphological and physiological point of view, may equally act on the grain, decomposing the protein substances and forming a toxin analogous to the supposed nitrogenous glucoside, isolated by O. GABRILOVITCH in the pure culture of *Fusarium roseum* Link on rye. On the basis of this hypothesis the writer, together with A. A. JATCHEVSKIJ and N. A. NAUMOV, carried out a series of experiments the object of which was: 1) to isolate and further study the toxin of intoxicating bread; 2) to make a chemical analysis of the mycelium of the different forms of *Fusarium*.

The present work is only the first part and contains the results of the qualitative and quantitative analysis of rye grain infested by *Fusarium*, such analysis being indispensable for further work, as was proved by the preliminary experiments on the isolation of the toxin. The material used was: pure cultures of *Fusarium* prepared in the laboratory, and the original Petrusk variety of rye infested with *Fusarium roseum* Link, coming from the

region of Ussurijsk, in Siberia; two samples were also taken of the rye in question, infested with *F. subulatum* App. and Woll., and originating one from the province of Tula, European Russia, and the other from the region of Ussurijsk; there were also utilised two samples of "Vasa" rye, infected with the pure culture of the above mentioned *Fusarium*, and finally, two uninfected and two sterilised samples of the same rye.

From the moment of inoculation with *Fusarium*, the culture was in a separate room away from the direct light of the sun, and kept at a constant temperature of 18-20° C. The analyses were made at the end of 10, 20, 30 and 60 days after the beginning of the experiment.

Results. 1) The vital activity of the two forms of *Fusarium* on the rye grains is accompanied by a large reduction of dry matter. Thus, in the analysis of the culture of *Fusarium roseum* made after 10 days, the loss of dry matter is about $\frac{1}{3}$ of the total quantity: when the experiment is further prolonged, the loss of dry matter increases, amounting to $\frac{3}{4}$ of the total on the 60th day. *Fusarium subulatum* in a 30 days culture exhibits an activity lower than that of the first *Fusarium*, but the difference afterwards disappears.

2) The dry substance lost is chiefly starch and albumin.

3) The loss of starch in one month is 61 to 80 %, and in two months 80 to 89 % of the initial quantity.

4) The vital activity of *Fusarium* is accompanied by the decomposition of albumin with loss of nitrogen. This loss is not so large as in the case of starch, being about 5 % in the culture of *F. roseum* for the first ten days. It is still less, (2.7 %) in a culture of *F. subulatum* one month old. At the 60th day, however, the losses of nitrogen for both forms of *Fusarium* increase, with an average of 12 to 16 %, common to both.

5) Both forms of *Fusarium* act equally on the rye, reducing the starch and decomposing the albumin, with production of ammonia.

6) The products of splitting up of albumin, as found from the analyses made, are the following: albumoses, peptones, amino-acids, organic acids, ammonia and a toxin (presumed to be a nitrogenous glucoside). The process of decomposition of albumin was most energetic in the cultures of *F. roseum* and a little less so in those of *F. subulatum*. The numerical data in relation to the quantity of decomposition products formed allow of the following description of the hydrolysis of albumin produced by *Fusarium*: during the first month of the experiment there are chiefly formed amino-acids, organic bases, peptones, nitrogenous glucosides, and a small quantity of ammonia, while in the second month the hydrolysis grows more energetic with formation of a considerable quantity of ammonia. The practical bearing of these observations is that, for the purpose of isolating and studying the poisonous principles of "intoxicating bread", the amino-acids and organic bases, a 3 to 4 weeks old culture of *Fusarium* may be used with absolute certainty of success.

7) The pentosans disappear fairly quickly, chiefly during the first 30 days; during the subsequent 30 days, the loss only increases 6 to 7 %; the total loss being 75 % of the initial quantity.

8) As regards cellulose, during the first 30 days some increase in its quantity is observable, due to energetic synthesis of chitin, which masks the loss of the crude cellulose. In the second month this synthesis slows down, and the decomposition of cellulose then becomes evident.

9) With respect to fats, the results are that, in the course of the first 30 days, their splitting up is masked by the synthesis due to *Fusarium*; in the second month, the breaking up process predominates, and a final loss of 21 to 51 % results. Under the influence of *Fusarium*, the iodine index of the fatty substance diminishes, while the acidity index increases, which means that in the splitting up of fats by *Fusarium* two processes occur concurrently; saponification of the glycerides, and oxidation of the unsaturated acids.

10) The percentage of acidity in the watery solution does not increase.

11) The quantity of mono-saccharides in the cultures of *Fusarium* is small and does not grow.

12) In a thirty days culture, no disaccharides were found which could be inverted with a 1 % solution of hydrochloric acid; after 60 days, they are present in a minute quantity (up to 0.25 %).

13) In view of the wide occurrence of "intoxicating bread" in the northern and central Governments of Russia, produced not only by *Fusarium roseum*, but by other forms of *Fusarium* also, the writer urges that the utmost attention should be given to the phenomenon in question.

743 - **Change in the Specific Gravity and in the Starch and Dry Matter Content of Potatoes during Storage.** - SZÉLL L., in *Kisérletiügyi Közlemények* (Bulletin of Hungarian Agronomic Stations), Vol. XVIII, Part 5-6, pp. 1020-1028. Budapest, 1915.

In October 1913, two varieties of potato: "Richter-Imperator" and "Up to date" from the 1913 crop were stored, partly in heaps on the field and partly in cellars. In the cellar-stored potatoes the specific gravity and the content of starch and dry substance were determined every fortnight; the same figures for the other potatoes were determined before stacking up and after storage. The results brought out the following facts:

The specific gravity and the contents of starch and dry substance (deduced from the specific gravity) increased generally in both varieties during cellar storage, but decreased in the field-stored potatoes. It follows that it is more economic to store potatoes in well-ventilated cellars than in heaps.

The increase in specific gravity of these two varieties of potatoes stored in cellars did not take place regularly, except before the tubers germinated. This must be attributed on the one hand to the different factors acting on the stored potatoes, such as healthy condition, respiration, germinating stage of the tuber, dampness of cellars, temperature, etc., and on the other hand to the fact that the results of the different methods of determining the specific gravity are influenced by the following factors: size, shape, maturity, hollows in the tubers, structure of skin, depth of eyes, adhesion of the water to the surface of the tubers, etc.

Determinations of specific gravity repeatedly carried out on specimens of the same class (cellar-stored) proved that the divergencies between the maximum and minimum values were greater in "Imperator" than in "Up to date". In the former the minimum content of starch was 13.9 % and the maximum 16.6 %, while in the latter the minimum content was 2.3 % and the maximum 13.9 %. Therefore the range was 2.7 % in "Imperator" and 1.6 % in "Up to date". The difference in the range of values in these two varieties is not merely accidental, but appears to be related to the fact that in "Imperator", especially in large tubers, big hollows occur more frequently, and this variety is more liable to rot than the other. This observation if practically applied to other varieties of potatoes might have useful results.

The variations in the specific gravity of potatoes checked by accurate analyses again confirm the fact that the usual rapid method of determination of starch and dry substance based on an estimation of specific gravity of potatoes furnishes only approximate and unreliable results.

744 - **Rapid action of Saline Solutions on Living Plants: Reversible Displacement of a part of the Basic Substances contained in the plant.** -- DEVAUX HENRY, in *Comptes Rendus de l'Académie des Sciences*, Vol. 162, No. 15, pp. 561-563. Paris, April 10, 1916.

By previous studies the writer ascertained that the cell walls, and in particular the pectose they contain, are able to fix energetically an appreciable quantity of all the bases present in the form of salts. Prolonged washing in distilled water does not remove the metals thus fixed. On the other hand, steeping for a short time in the solution of another metal causes the immediate separation of the metal which distilled water had been unable to remove. These phenomena of mutual displacements are reversible. Just as alkaline metals can be displaced by all others, in particular calcium, the latter can in turn be expelled by alkaline metals.

These results at once suggested the question whether the interchanges observed on isolated cell walls also take place in living plants.

The question is answered by the following investigations :

A 10 to 15 gram lot of some aquatic plant was placed in a suitable vessel and carefully washed with distilled water (distillation carried out in glass in order to avoid the marked traces of copper or lead frequently found in commercial distilled water), after which, it was subjected to the following steepings of 30 minutes each: 1) in 250 cubic cc. of distilled water; 2) after washing with distilled water, in 250 cubic cc. of 1 per 1000 saline solution; 3) after careful washing with distilled water, in 250 cc. of distilled water. The liquid was tested with oxalate of ammonia after each maceration. Result: no calcium after the first and third maceration; presence of calcium after the second maceration (in saline solution).

It follows from these experiments that a very rapid decalcifying action of the plant was produced by the alkaline salts present in the solutions employed. This decalcification is a general phenomenon, having been observed by the writer in various plants (phanerogams, cryptogams, aquatic roots, terrestrial plant roots, etc.) and with different salts. The decalcifying salt may be an alkali or alkaline earth, but it may also have any acid

radical. Any one of these salts causes the immediate separation of a little calcium, which increases as the action is prolonged, and finally represents a considerable proportion of the total weight of calcium in the plant.

It is not only calcium which is thus expelled from living plants by any other metal present in the state of saline solution. For instance, potassium is also separated on treating the plant with a calcium salt. Thus the cycle is complete for all alkaline or alkaline-earth metals. The calcium in plants is expelled by the salts of other metals, but the other metals are expelled by the salts of calcium. It is a perfectly reversible phenomenon, in which the action of the most abundant salt preponderates.

There is a remarkable similarity between the absorbent properties of the soil for saline solution and those exhibited by living plants. In both cases the fixation relates mainly to the bases, and these bases can expel each other reversibly. This forms the direct demonstration of a contention put forward by the writer in 1904; "the pectose in the walls of root hairs being in close contact with the particles of the soil, the whole together, soil and walls, forms a colloidal system having the same properties of absorption everywhere. The bases are not held and kept in reserve in the soil but also in the cell wall within immediate reach of the protoplasm". Indeed there is nothing to show that the cell content itself does not take part in the exchanges, and this simple hypothesis shows the importance which may attach to the study of these reversible exchanges in living tissues.

745 - The Relations between the Presence of Magnesium in Leaves and the Function of Assimilation. — ANDRÉ G., in *Comptes Rendus de l'Académie des Sciences*, Vol. 102, No. 15, pp. 563-566. Paris, April 10, 1914.

Several authors have proved that crude chlorophyll, extracted from leaves by alcohol or benzene always furnishes an ash in the composition of which magnesium phosphate predominates; other more recent work has also shown that magnesium is the only fixed element forming a part of the molecule of chlorophyll; finally, M^{lle} MAMELI demonstrated that the quantity of pigment forming in the assimilating organs is related to the weight of magnesium supplied to the plant.

If magnesium plays so special a part in the molecule of chlorophyll, it might be expected that the weight of this element would be greater in proportion as the process of assimilation reaches greater intensity in the plants from which it is extracted. The writer therefore, at different vegetative periods, detached a number of leaves from different species of plants, dried and crushed them, afterwards extracting them by heating with ether and afterwards with alcohol. He measured the magnesium and phosphorus in the product of the extraction. He thus determined the weight of phosphorus (reckoned as H_3PO_4) and of magnesium (reckoned as MgO) contained per 100 grams of substance dried *in vacuo* at the different times: 1) in the part of the leaf substance dissolved in the ether and alcohol (organic phosphorus and magnesium); 2) in the part not dissolved (residual phosphorus and magnesium).

From the table giving these figures, and also the relations between organic phosphorus and residual phosphorus on the one hand and organic

magnesium and residual magnesium on the other, it is found that the absolute weight of organic magnesium increases from April to May in chestnut and lilac leaves. The maximum is reached on the 4th May in the former case, and on the 3rd in the latter. Beyond those dates this weight decreases almost regularly. With regard to the leaves of the chestnut tree the maximum weight of magnesium is reached on the 26th April. Taking on the other hand the ratio between the weights of organic and those of residual magnesium, this ratio is found to reach its maximum on the 26th May in the leaves of the horse-chestnut, on the 3rd May in those of the lilac, and not until the 14th June in those of the common chestnut. Assuming that the time when this ratio reaches its maximum corresponds, at any rate in the year under consideration, to the maximum activity of assimilation, it must be concluded that this process is most active during the whole of May in the horse-chestnut, at the beginning of May in the lilac, and between the end of May and the middle of June in the ordinary chestnut. On the other hand, on comparing the ^{organic phosphorus} and ^{residual phosphorus} ^{organic magnesium} ^{residual magnesium} a satisfactory agreement between the maxima of these two ratios is found in the horse-chestnut leaves. Although this agreement is less marked in the other two species of leaves studied, it is reasonable to assume that the maximum of vegetative activity is at the same time manifested by the elaboration of carbohydrates and the concurrent production of the organo-phosphoric compounds the existence of which is unquestionably bound up with the chlorophyll synthesis.

These experiments should be resumed subsequently on other plant species.

746 - **Comparative Tests of 4 Varieties of Barley at Torestorp, Sweden.** — HJALMAR VON FÉLITZEN, in *Scenska Mosskulturförningens Tidskrift* XXXth Year; No. 1, pp. 57-60, Jönköping, 1916.

Tests covering a period of 6 years (1909 to 1914) at the Station of Torestorp. Manure: superphosphate, 178 lb per acre (in the last years 267 lb.), potash salts of 37 % strength 178 (267) lb. per acre. The varieties tested were always sown at the same time, the time of sowing varying from the 7th to the 15th May in different years. The crops were more or less damaged by spring frosts. This was the case in 1909 and 1913. In 1910 the 6-rowed barley, an early variety, was the only one to suffer from the low temperatures.

As appears from the Table, the annual fluctuations of yield are very great. The best results were in 1911. In that year the "Svanhals" variety gave a yield of about 23 cwt. per acre. The same was the case in 1914, in which year the 6 rowed barley furnished a yield of about 23 $\frac{1}{4}$ cwt. per acre. The worst years were 1909 and 1913, with yields of 31 cwt. and 24 cwt., owing to the spring frosts which in those regions form the most frequent weather feature, and the one which does most injury to the cereal in question.

As regards the yield of grain, the "Plymage" variety furnishes the

Results of Tests.

Varieties	1909	1910	1911	1912	1913	1914	Averages
-----------	------	------	------	------	------	------	----------

Straw yields (cwt. per acre).

Plymage	38 ¹ / ₄	41 ¹ / ₁₀	41 ³ / ₅	47 ¹ / ₅	60 ¹ / ₂	40 ¹ / ₂	44 ⁴ / ₅
Primus	42	42	45 ⁴ / ₅	41	55 ⁴ / ₅	38 ¹ / ₂	44 ¹ / ₅
Svanhals	36 ¹ / ₈	41	42 ³ / ₅	46 ⁹ / ₁₀	52	39	43
Sexradigt	37	41 ³ / ₄	34	36	45 ¹ / ₃	36 ³ / ₄	38 ⁴ / ₅
Averages	38 ¹ / ₂	41 ³ / ₁₀	40 ⁴ / ₅	42 ⁷ / ₁₀	53 ¹ / ₃	38 ¹ / ₂	42

Grain yields (lbs per acre).

Plymage	1 576.41	2 126	2 440	2 392	930 ¹ / ₂	2 176	1 940
Primus	1 440	2 044	2 344	1 966 ¹ / ₂	820	1 510	1 670
Svanhals	1 200	2 136	2 580	2 302 ¹ / ₂	990	2 052	1 879
Sexradigt	1 429	996	2 373	1 980 ¹ / ₂	1 583 ¹ / ₂	2 625 ¹ / ₂	1 846
Averages	1 411.38	1 825 ¹ / ₂	2 432	2 145	1 083	2 001	1 836

Weight of 1000 grains in grams.

Plymage	38.8 g	41.6 g	42.7 g	46.6 g	30.7 g	46.1 g	41.1 g
Primus	40.4	43.4	42.2	51.5	35.9	50.8	44.0
Svanhals	39.6	42.6	43.8	45.4	34.8	47.2	42.2
Sexradigt	30.0	31.2	36.3	37.3	25.6	37.0	32.9
Averages	37.2 g	39.7 g	41.3 g	45.2 g	31.7 g	45.3 g	40.0 g

Weight per bushel in lbs.

Plymage	41.60	50	54.51	52.27	36.32	52.75	48.00
Primus	46.18	51.55	53.07	52.91	40.89	52.27	49.40
Svanhals	45	49.63	52.75	50.11	38.08	54.03	47.70
Sexradigt	43.30	42.49	55.32	53.39	36.21	52.75	47.30
Averages	44.02	48.42	53.9	52.19	40.43	52.95	48.30

Length of period of vegetation (days).

Plymage	111	112	95	109	108	94	105
Primus	111	112	95	109	108	94	105
Svanhals	111	112	95	99	108	89	102
Sexradigt	102	112	93	99	104	89	100
Averages	109	112	94	104	107	91	103

best crops on the average, while the "Primus" variety is found inferior to all the others tested. On the other hand, as regards straw yield and weight per bushel the varieties "Plymage" and "Primus" are equal, and markedly superior to the two others. "Primus" gives the biggest weight per 1 000 grains (44.0 grms.), and is followed by "Svanhals", "Plymage" and "Sexradigt" with 32 grms. only.

Finally, the duration of the vegetative period varied from 91 days in 1914 to 112 days in 1910. The 6-rowed barley is harvested on the average, 5 days, and "Svanhals" 3 days before "Plymage" and "Primus", which are last, and ripen simultaneously. From the results of these 6 years' tests as a whole, it may be concluded that the two varieties "Plymage" and "Svanhals" in the region of Torestorp and in all other localities with equal climatic and soil conditions, should be preferred to the varieties "Sexradigt" and "Primus", in spite of the excellent quality of grain marking this latter variety.

717 - **Comparative Tests with 8 Races of Oats, at Flahult, Sweden.** — HJALMAR VON FEILITZEN in Svenska Mosskulturforeningens Tidskrift, Year XXX, No. 1, pp. 65-67. Jönköping, 1916.

Comparative cultivation experiments with 8 races of white and black oats conducted in 1915 at Flahult in sandy and peaty soil.

The oats were sown on the 29th April. The frosts at the end of May and lack of rain at the time of earing, caused great damage to the sown fields and reduced the crop considerably.

Among the white races in particular, there was a high percentage of ears which were empty, or poor or inferior in quality of contents. We reproduce some corresponding data: (Table I, page 968).

Owing to the unfavourable weather, both the straw and grain yields were low. The best comparative results were obtained with the two strains of German oats for peat soil, and the worst with Klock II. The two new types of Svalof black oats were, contrary to expectation, inferior to the German oats; the shortness of the period of observation, however, does not allow of definitive conclusions on this point. We quote the following average results:

White	Number of years of test	Straw yield per acre — cwt.	Grain yield per acre — lbs
Probsteler	7	38.36	2 068
New German light yellow oats for peat soil	5	38.32	2 037
New German golden-yellow oats for peat soil	5	38.42	1 800
Black			
Black German oats for peat soil	7	34.79	2 488
Klock II	5	41.27	2 408
Black Nordfinsk oats	5	37.82	2 171

Among the black races examined at Flahult, the German oats lead, proving superior to the Klock, which is nevertheless remarkable for its abundance of straw. The Nordfinsk always gave unsatisfactory results and is certainly not able to compete with the other races. With regard to the

TABLE I.

	Straw cwt per acre	Grain lbs per acre	Bad Grain lbs. %	Qualities of grain			Days between sowing and earring	Length of entire vegetative period in days
				Weight of 1000 grains in lbs.	Weight of 1000 grains in grams	Percentage weight of kernel %		
<i>White:</i>								
New German light yellow oats for peat soil. . . .	30.57	1 603	8.8	36.96	28.8	68.9	68	106
do. golden-yellow	34.27	1 471	11.4	37.76	26.0	68.2	68	106
Probsteier	34.50	1 385	16.1	30.96	29.2	67.7	78	113
<i>Black:</i>								
Black German oats for peat soil	22.93	1 721	3.6	37.12	30.0	72.6	68	101
Black Svalöf oats No. 01120	31.90	1 431	8.4	37.28	27.8	73.3	69	106
Black Svalöf oats No. 01101	26.36	1 373	7.8	36.24	30.8	70.3	69	104
Black Nordfinsk Oats. . . .	28.05	1 239	7.4	37.44	27.1	71.7	68	104
Klock II.	33	1 070	19.6	34.79	28.7	67.9	76	110

white oats, the Probsteier is somewhat superior to the two German types, but the latter nevertheless represent very good varieties particularly adapted to peat soils.

748 - **Strawberry Breeding in the United States.** — *The Journal of Heredity*, Vol. VII, No. 4, p. 191. Washington, April 1916.

Probably with no single fruit has more been accomplished by scientific breeding than with the strawberry. Of the 200 000 acres or thereabouts which are planted to strawberries in the United States, it is probable that 90 % are planted to varieties which have been produced during the last quarter of a century.

Strawberries have been grown in the United States ever since the country was first settled, but the original strains bore fruit only in the early summer. One of the greatest advances in the industry was the introduction of the fall-bearing or ever-bearing varieties, the first of which was Pan-American, produced by SAMUEL COOPER, of Delevan, N. Y., in 1898. This was a sport from the variety Bismarck, which bore only in the early summer. Mr. COOPER produced a number of seedlings by self-fertilization from this sport and then crossed them with each other and back on the parent. In this way a number of other more desirable varieties were obtained. Crossing Pan-American with Dunlap (Senator Dunlap), a widespread and famous variety, HARLOW ROCKHILL, of Conrad, Iowa, produced in 1908 the variety Progressive, which has proved one of the most popular in the northern States.

Dunlap itself which has long been the most widely grown northern variety, originated with Rev. J. R. REASONER, of Urban, Ill. in 1890, but was not introduced to the trade until 1900. It was the result of definite breeding.

The variety Klondike, which makes up probably nine-tenths of the area planted in the southern States, was produced as long ago as 1895 by ROBERT CLOUD of Louisiana, as a result of a carefully planned cross.

The ease with which results are got appears to be the principal reason why plant breeding has been so much more widespread with the strawberry than with any other fruit. Crosses are easily made, seedlings are easily grown, and they multiply so rapidly by runners that a large stock can be obtained in a very short time.

749 **Sowing and Transplanting Rice on the "Dapog" Method, peculiar to some parts of the Philippines.** — APOSTOL SILVERTO, in *The Philippine Agricultural Review*, Vol. VIII, No. 2, pp. 98-102, Manila, 1915.

The practice of growing 2 rice crops per year is of old standing in those parts of the Philippines where sufficient water for irrigation is always available. As soon as the first crop is taken off, the land is prepared for the second. The earliest irrigated rices are used, with the twofold object of cropping before the rainy season has fully set in, and allowing the necessary time for tillage for the main crop. Direct broadcast sowing (by hand) is the only one used for the second crop wherever it is grown in the Philippines (provinces of Tarlac, Pampagna and Laguna), except in the communes of Calanan and a small part of that of Bay (Laguna), where the special method of sowing and transplanting called "dapog" is in use. This method allows the plant-lets to be transplanted without breaking them, at a younger age than with ordinary seedlings. Earliness is of prime importance for the dry season crop. It is therefore necessary to transplant *young* plants, their age having a direct influence on the period of ripening of the rice. The crop ripens later in proportion as the age of the transplanted plants is more advanced. A difference of 23 days even has been found in the time of ripening between rice transplanted on the "dapog" method and that transplanted on the ordinary method.

For the "dapog" method the seedling plot requires neither special soil nor special tillage. It is filled with the rest of the rice field. It must, however, lie near the water channel, so that the water should have no time to get hot, during the hours of great heat, and scald or otherwise injure the germinating seeds.

Sowing on the "dapog" method requires 1.3 to 2.6 gallons of seed more per acre than on the ordinary method. The seed, put into a coarse canvas bag, is immersed in water (preferably slow moving water) for 24 to 36 hours, then spread out in the shade. 36 hours later, or when at least 75 % of the grains show signs of germination, the seed is put down in a seed plot prepared as follows:

The seed plot area, after irrigation, drying, ploughing and harrowing, is harrowed again on the day of sowing. When the soil is levelled and the silt settled, the water is run off, the soil is covered with whole banana

leaves, cut along the midrib, and placed so that the latter forms a border right round. Care must be taken to fill all vacant spaces with leaves with their midrib excised. It is still better to build up with two or three layers of leaves a bed of a width of about a yard and a length nearly equal to that of the ricefield dyke. On the leaves a layer of 2 to 2 ½ cms. of rice husk or finely chopped rice straw is placed, and on it the germinated rice is sown very closely. 16 ½ gallons of seed suffice for sowing 2 beds 16 yds. in length by 3 ft 3 ins. in width each.

The afternoon is preferable for sowing, and it is advisable to strewn carefully over the seed the mud lying around the seed plot. It is generally necessary to protect the plot against excessive heat by placing at a height of 11 to 16 inches above it light shelters made up of banana leaves spread over a bamboo and board framework. During the first few days after sowing the plot is watered several times a day. In the work of the writer the use of ordinary garden watering cans was found very practical. Later on, when the seedlings are no longer liable to be carried away by the water, they should be irrigated with slow running water until the time of transplanting, because stagnant water might, during a day of great heat, seriously injure the young plants. Care will be taken of course not to submerge them, and never to leave them dry. The roots, being unable to pass through the banana leaves, grow laterally rather than vertically, and interlace with each other, forming a carpet easily separated from the sort of matting placed below. At transplanting, the interlaced roots are cut into strips of a length such as can be kept spread over the arms and shoulders, or both the young plant roots and the banana-leaf matting are cut into strips. They are rolled up slowly with the banana-leaf outside and unrolled on reaching the field.

Here the root matting is cut up into fragments of about the size of a small plate, which are distributed over the rice field at regular intervals, and is done with the small bundles of young plants in the ordinary method of transplanting. In carrying out their work the transplanters hold the fragment of root matting in their left hand, keeping it spread over the palm by means of the thumb of the same hand. With the first 3 fingers of the right hand, they detach a tuft of several plants and plant it in the mud. The young plants are ready for transplanting 10 to 14 days after sowing. Experience proved to the writer that if the plants are healthy and transplanting is skilfully done, 3 or 4 per bundle, at the ordinary distance of 4 or 6 in square, are sufficient to ensure regular growth and a maximum crop, under ordinary conditions. Generally, however, transplanting is done much more densely. The young plants, if transplanted more than 11 days after sowing, are greatly weakened and many die. If they have grown with exceptional vigour, they must be topped before transplanting. The seed plot is planted like the rest of the field after taking away or turning in the banana leaves. The rice-field is harrowed and covered with silt for the last time on the day of transplanting or partly the day before.

By the "dapeg" method the yield obtained is higher than by direct sowing. Under labour conditions in the Philippines the value of the sun

plus exceeds the increased cost of production due to transplanting. The "dapog" method is thus making its way into localities where it was quite unknown even lately. It is applicable not only to the second crop rice, but also to the regular crop of early irrigated rice.

750 - **Early Weeding of Rice Fields.** - NOVELLI N., in *Giornale di Agricoltura della Domenica*, Year XXVI, No. 19, p. 154. Piacenza, May, 7, 1916.

In cases of shortage of labour at the time when rice fields are usually weeded it is advised that this should be done with all available labour as early as possible *i. e.* directly the rice has germinated. Early cleaning is of special advantage in new rice fields, particularly cleared meadow land. In these rice fields various meadow plants continue to grow long after flooding. The practice is also of advantage in old rice fields which, shortly after flooding, are overrun by the weeds called "erba grossa" (*Ranunculaceae*, *Alisma* *Plantago*, *Glyceria fluitans*, *Cyperus* spp., etc.). Early cleaning will destroy these different weeds more readily and effectively, so that the next time it is done there will be nothing to remove but *Panicum Crusgalli* and reeds (*Cyperus* spp.). The treading down of the recently ploughed soil during the cutting back is rather advantageous than injurious through the ensuing consolidation of the soil.

Early weeding has been adopted for several years by the brothers SANCIO, who have found that it promotes and improves the growth of the rice while reducing the total cost of the work of cleaning.

751 - **Experiments in Manuring Rice with Burnt Paddy Husk, in Burmah.** - THOMPSTONE E. and SAWYER A. M., in Department of Agriculture, Burma, Report of the Mandalay Agricultural Station for the year 1914-1915, pp. 10-12. Rangoon, 1916.

The rice field used for these trials was divided into 4 plots, 2 being test or control plots, while the other 2 were, for 5 years running, manured with burnt rice husk in the proportion of 12 000 lbs. per acre, which manuring was afterwards stopped. The appended Table sums up the results during the 7 years 1908-1909 to 1914-1915.

*Results of Manuring Rice with Burnt Husk, in lbs per acre.
(average of 2 plots).*

Plots	Crop 1908-09	Crop 1909-10	Crop 1910-11	Crop 1911-12	Crop 1912-13	Crop 1913-14	Crop 1914-15	7 years average
<i>Manured :</i>								
Grain. . .	676	1 746	1 321	1 620.5	2 300	1 856	1 758.5	1 611.2
Straw. . .	2 300	1 998	1 348	1 719	2 603	2 345	925	1 891.1
<i>Unmanured :</i>								
Grain. . .	950	2 005	1 412	1 112	1 386.5	1 771.5	1 273	1 330.1
Straw. . .	2 562	3 560	1 715	1 533	1 429	1 141	805	1 822

In the first year of dressing with burnt husk there was a falling off in the yield, probably due to the fact that the late application had not allowed the burnt husk to mix thoroughly with the soil. In the second year there was an improvement. In the third, fourth and fifth years a yield of 30.5 and 64 % above that of the control plots was obtained respectively. Even allowing for experimental errors, there is still sufficient margin to demonstrate the beneficial effect of the dressing with burnt husk, which was due probably to the physical improvement of the soil, which was of a clayey nature, compact and impermeable. The after-effect of this dressing during the 2 years (1913-1914 and 1914-1915) when it was suspended was manifested by an excess yield of 58 % and 38 % respectively; this decline, however, seems to suggest that the effect produced tends gradually to disappear.

The experiment will be continued.

752 - **Accumulated Fertility in Grass-land in Consequence of Phosphatic Manuring.**
SOMERVILLE W. (Professor of Rural Economy in the University of Oxford), in *The Journal of the Board of Agriculture*, Vol. XXII, No. 12, pp. 1201-1206, London, March 1916.

This new contribution of the writer to the manuring question brings out clearly the importance of the accumulated fertility resulting from continued dressing of permanent grass-land with slag. The greater production of meat, milk and stable manure obtained by means of these fertilisers is the consequence of the increase in forage production only represents a part of the benefit provided by such fertilisation, because, side by side with the greater production of forage, an increased fertility is observed in the soil which is probably proportional to the increased production, and is a beneficial effect of manuring grass-land with slag which has hitherto not been sufficiently appreciated.

The experiments carried out show that this accumulation of fertility is in proportion to the quantity of slag applied, the period during which the fertiliser exerted its action and the response of the soil to such fertiliser.

As a result of the use of this accumulated fertility there were obtained at Cockle Park, in 1914-1915, 70 per cent increases in wheat crops, and the 5th mustard crop (1915) showed no sign of exhaustion of this fertility. At Denton Hill and Armcot, where the grass land had been dressed with the slag and for a shorter time, the increased production due to the accumulated fertility was less notable; nevertheless it averaged 27 per cent for the lands considered.

In view of the possibility of a larger extension of the tillage area in England, the writer points to the importance of this excellent slag manure for natural grass land, as the farmers who have abundantly manured their grass lands will be the first to benefit by this stored up fertility. As regards superphosphate the Author is of opinion that even if it could do no more than accomplish a 10 per cent increase in 2 tillage crops, this would be sufficient in many cases to pay the original cost of the treatment.

- **Chemical Determination of the Fibre Yield of Flax for the Purpose of Studying the Influence of Different Cultivation Factors on such Yield.**—LINNIK, JA., in *Сельское Хозяйство и Лесоводство* (Agriculture and Sylviculture), pp. 224-246. Petrograd, February 1916.

The writer, after reviewing the different methods of steeping flax, describes the chemical method devised by him in the laboratory of technological chemistry for textiles in the Technological Institute of Petrograd. He considers it preferable to all others, as it enables the investigation of the yield of fibre to be conducted under perfectly equal conditions dependent only on the will of the investigator. In other words this method affords the possibility of obtaining comparative data for studying the influence of the different factors, for instance, manuring, on the fibre yield.

The method consists in treating the flax stalks with solutions of sulphuric acid and alkalis in an apparatus specially designed for experiments in the treatment of textile materials with chemical reagents. This treatment is carried out in a special boiler fitted with a feed heater and a centrifugal pump ensuring continuous circulation of the liquid. After careful washing with water, the wet stalks are put through the press and afterwards dried in current of air heated to a temperature not exceeding 40° C.; they are kept three days in this environment with constant humidity and temperature at which they are broken and combed. The flax stalks were chosen in three different places and three different groups of them were formed. The results of the analysis, with reference to the percentages of weight lost by the stalks after the chemical treatment, and the percentage of fibre yield, are as follows:

Manure	Percentage of loss by weight of the flax stalks			Average percentage of loss by weight	Number of plots	Percentage of yield in textile fibre			Average percentage of yield in textile fibre
	1st group	2nd group	3rd group			1st group	2nd group	3rd group	
1	15.19	15.57	16.47	15.75	11	41.6	32.8	38.9	37.8
2	—	13.71	16.31	15.01	2	—	35.5	37.5	36.5
3	—	17.12	17.21	17.17	2	—	32.4	33.5	33.0
phoric Acid	—	18.52	16.71	17.62	2	—	30.0	36.6	33.3
gon and phosph. acid	17.61	13.89	15.92	15.62	3	39.5	39.0	35.6	38.0
gon and phosph. acid	16.10	15.35	17.39	16.61	3	41.3	34.6	36.9	37.6
sh and phosphor. acid	17.27	16.13	16.11	16.51	3	37.1	33.9	34.9	35.3
.potash and phos.acid	14.38	17.21	17.47	16.35	3	41.1	31.2	34.9	35.7

On comparing the data in respect of loss of weight of the stalks with that of the average fibre yield, and allowing for the quality of the soil, which exerts great influence on the chemical composition of the flax stalks, the necessary guidance for selection of this plant may be obtained. The experiments carried out, however, are in the author's view only first trials,

and the chemical laboratory method of treatment of textile plants should be studied in fuller detail, being capable of a wider application and promising important economic results.

754 - **Piassava Industry of British West Africa.** — *Bulletin of the Imperial Institute*, Vol. XIII, No. 4, pp. 555-556. London, October-December 1915.

West African Piassava is a brushmaking fibre obtained from the leaf-sheaths of the wine-palm (*Raphia vinifera*). It is produced in most of the British West African possessions, but chiefly in Sierra Leone.

The exports of piassava from Sierra Leone in 1914 were 983 tons, value £ 19 492, as compared with 839 tons, value £ 12 280 in 1913. The exports from Nigeria were 403 tons, value £ 5 117 in 1914, as compared with 221 tons, value £ 2 806 in 1913. No exports of the fibre from Gambia or the Gold Coast have been recorded in recent years. The piassava industry in the Gambia appears to be worthy of attention with a view to development. The palm grows on the banks of the river, which is navigated by ocean-going-vessels.

In the course of preparing piassava in Sierra Leone, a fibrous by-product is obtained which hitherto has not been utilised. In order to ascertain whether this material has any commercial value, a sample was forwarded recently to the Imperial Institute for examination.

It consisted of a matted mass of reddish-brown fibre, resembling coir in appearance. The material was fairly clean, the fibres were very irregular in size, strength and length; this latter varied from 1 to 3 ft., but was mostly from about 20 to 30 in. The fibre contained 9 per cent moisture; 3.4 per cent ash; 65.8 per cent cellulose. The material would be accepted on the market as a substitute for low-grade coir, and would realise about £ 6 to £ 8 per ton in London, if shipped in good dry condition in pressed-packed bales (March 1915).

755 - **Influence of Green Manure on the Germination of Oil Seeds.** — See No. 734 of this *Bulletin*.

756 - **Investigations in Reference to Henna.** — CORTESI F. and TOMMASEO G., in *Annali della R. Stazione Chimico-Agraria Sperimentale di Roma*, Series II, Vol. VIII, pp. 75-111; Rome, 1916.

This short monograph sums up the results of botanical and chemical investigations with a view to determining the methods of cultivation, uses, adulteration and market conditions of this plant, which is of considerable economic importance for Tripoli.

I. — **BOTANICAL INVESTIGATIONS.** — The data and description of the plant prompt CORTESI to adopt the name of *Lawsonia inermis* L. in the wider sense rather than that of *Lawsonia alba* Lam. contained in the INDEX REWENSIS, because it was LINNE who named the *Lawsonia* genus and although the difference between *inermis* and *spinosa* corresponds to two epochs in the age of the plant, the specific name of *L. inermis* should be kept (as KOEHNIG also thinks) on grounds of priority. The plant, which is cultivated in all tropical regions, may reach a height of 23 feet. The obovate or oblong or widely lanceolate leaves are 12-67 mm in length and 5-27 mm in width.

The colour of the flowers, white in the *alba* variety, is pale sulphur and also variegated in the *miniata* variety. The leaves are the most important part used and a careful description is given, together with a series of measurements. The commercial product is formed by the dried leaves, which are rarely whole, and are greyish green or yellowish brown in colour according to the age of the product. Impurities are often mixed with these leaves, such as pieces of branches and fruits, and debris of other plants, which must be regarded as added for fraudulent purposes when found in considerable quantities.

Henna has been used from the most remote times as a dye plant by the Eastern peoples: the Arabs use it as an excellent cosmetic for different purposes and also as a medicinal plant. Its dyeing qualities are widely utilised for wool, silk and wood, and in Europe it is also esteemed as the only really harmless vegetable dye. From an analysis of several samples coming from Tripoli, the writer found that the most usual frauds and adulterations consist in the addition of fragments of fig, pomegranate, olive, almond and other leaves or wood, thoroughly ground and mixed to the powdered product.

The cultivation of henna is very extensive in the fields of Tripoli and is always irrigated. The plantlets are raised in nurseries and transplanted in the spring, being planted in parallel rows at a distance of 50×50 cm. No manure is applied. Irrigation is carried out every 6 days. The plantation is hoed in the spring and sometimes again in the autumn, and some weeding is done. The crop lasts about 12 years, the maximum growth being reached in the second or third year. The crop is usually taken off in February and August or September, the whole of the above-ground part of the plant being cut. The annual yield of dried leaves varies from 15 to 19 cwt per acre.

II. — CHEMICAL INVESTIGATIONS. — According to TOMMASI henna is one of the few plants which have escaped the vigilance of plant chemists. The appended table gives the results of direct analyses and other additional determinations:

Results of Henna Analyses.

Determinations	Leaves	Branches
	per cent.	per cent.
Moisture at 100°-105°C	10.67	11.40
Fat (ether extract)	0.04	0.60
Crude fibre	10.51	22.02
Nitrogenous substances	13.25	0.25
Ash	8.04	3.28
Non-nitrogenous extract (calculated)	50.84	55.55
	100.00	100.00
Reducing sugars	14.04	0.14
Hydrolysable sugars	14.25	0.30
Pentosans	7.47	11.72
Tannin (cortex)	0.72	2.95
Soluble substances (extract)	30.30	15.70
Ash	3.80	—
Substances soluble in acetone	18.73	—
Substances soluble in absolute alcohol	33.71	—

The tests of the watery extract of the plant proved that the tannic substances contribute very much to imparting the different shades to wools, mordanted or not with metallic salts, and dyed with the extract of the branches or leaves. Dye tests made with cotton, wool and silk are dealt with in a table where it is shown that the results with cotton are insignificant, while with wool and silk the pigment is fixed even without mordant. The writer extracted the pigment from the leaves in the form of fine tufts of orange-yellow needles in a quantity of 2 grams per kilogram of dried henna; this pigment behaves like an acid dyestuff.

757 - **Production of Medicinal Plants in Italy.** — CORTESI FABRIZIO in *Natura, Rivista di Scienze naturali*, Vol VII, pp. 1-44, Milan, January-April 1916.

General considerations on the conditions of the growing of and trade in medicinal plants in Italy, followed by: 1) a list of medicinal plants (78) found wild in the Italian flora, and a synoptic table of their geographical distribution in Italy; 2) a list of the average prices quoted on the principal Italian markets for the chief medicinal drugs before and during the European war; 3) a table of Italian imports and exports of the principal medicinal drugs during the years 1912 to 1914.

The Italian flora is very rich in wild medicinal plants, but the trade in these is far from being as considerable as it should be, $\frac{9}{10}$ of it being in the hands of ignorant herbalists. Italy produces and exports (whole or in parts) the following medicinal plants:

Absinthe, aconite, adonis, agaric, almond, angelica, common aniseed, arnica, burdock, belladonna, borage, field camomile, Roman camomile, maidenhair, centaury, chicory, couch-grass, hemlock, colchicum, cumin, digitalis, hellebore, eucalyptus, eupatory, male fern, fennel, gentian, pomegranate, juniper, germander (official), hops, hyssop, iris, master-wort (root), henbane, laurel, cherry-laurel (leaves), lavender, lichen, flax (seed), mallow, woody nightshade, lily of the valley, manna, bugleweed, melissa (balm), mustard (seed), mint, perforated St. John's-wort, myrtle, walnut (leaves), poppy (heads), herb patience, parietary, dandelion, plantain, phellandrium, pulicaria (seeds), bear-berry, liquorice, castor oil plant, rosemary, sweet-rush, soapwort, sage, squill, spurred rye, stavesacre, thorn-apple, elder, lime tree, thyme, marsh clover, saffron, coltsfoot, valerian, violet.

Some of these plants, such as mallow, field camomile, castor oil, etc., although partly exported also need to be imported, the production being insufficient to meet the demands of national industry.

In Italy, the production of essential oils is at present confined to Sicily and Calabria, with regard to citrus oils, and to Piedmont for peppermint oils. In 1914 Italy exported: essential oils of citrus fruits, 74 558 cwt of a value of £ 484 326 (as against 92 776 cwt value £ 603 822 in 1913); spirit of peppermint: 23 521 cwt value £ 23422 (as against 43 885 cwt value £ 43 698 in 1913). The Italian spirit of peppermint is of absolute purity.

Trials of aloes cultivation (*Aloe vulgaris* Lamk.) have been undertaken in Sicily, and a juice fairly rich in active principles appears to have been obtained from the leaves. Sicily possesses almost a monopoly of the pro-

duction of manna (1), which it exports to all parts of the world. Tuscany and the province of Verona produce the best qualities of iris (*Iris florentina* L., *I. germanica* L., and *I. pallida* Lamk.). Some time ago, i. e. before the appearance on the market of Russian liquorice (probably *Glycyrrhiza uralensis* Fisch.) and liquorice juice prepared in a factory near Tiflis, the most important liquorice-growing countries (*G. glabra* L. and *G. echinata* L.) were Italy and Spain. The Italian liquorice plant is chiefly used for the extraction of the liquorice juice, which is exported throughout the world.

Many plants rich in alkaloids and glucosides find suitable conditions for their growth in Italy; these are principally belladonna, henbane, stramonium, aconite and digitalis. The Italian belladonna, especially that of the Abruzzi, is excellent, but its production is not sufficient for home consumption; the same applies to henbane and stramonium. In Brianza, at Brunate, Caviglio and their environs (province of Como), there are fields where digitalis is chiefly grown for pharmaceutical purposes. In Sardinia, chiefly in the forests of Ortobene, beyond Nuoro (province of Sassari), large quantities are found wild, but are rarely harvested. Cultivation of the opium poppy (*Papaver somniferum* L. var. *album*) has long been carried on successfully in Sicily. The castor oil plant is extensively grown in Italy, especially in Venetia, but a considerable quantity of seeds of this plant is imported. In 1914 such imports amounted to 191 127 cwt worth £120 401 (as against 217 581 cwt worth £139 192 in 1913). The exportation of castor oil was 4954 cwt worth £12 949 in 1914 (against 10 442 cwt worth £19 520 in 1913).

As regards saffron (*Crocus sativus* L.), Italy exports it to the value of about £8 000 per year, but imports from Spain 80 to 90 cwt per year of a value of about £20 000. The competition of Spanish saffron with that of Aquila was greatly assisted by the standard packing in small sacks of 44 lbs. leadsealed and guaranteed, which contain the pure stigmas.

Finally, the Author advises that in addition to trials of alics and opium poppy cultivation in Italy, the growing of Spanish camomile, hydrastis and camphor should be begun.

758 - **Bridge Grafting of Fruit Trees.** — FLETCHER W. F., in U. S. Department of Agriculture, *Farmers' Bulletin* No. 710, 8 pp., 7 fig. Washington D. C., February 21, 1916.

For the treatment of trees that have been girdled round the base of the trunk by injuries due to quadrupeds, parasitic insects, or mechanical agents, the writer advises "bridge grafting", made by using scions or small limbs to connect the two portions of the bark of a stock which have been separated by injury, the ends of the scions uniting with the uninjured parts above and below the wounds. The accompanying illustrations indicate the way in which the combinations of these scions form bridges of bark over the previously exposed part of the wood, the plant consequently continuing a healthy life.

When the girdle of bark removed from the trunk is too wide to permit of the above grafting, young plants of the same species are transplanted

(1) See *B. June* 1915, No. 612.

round the base of the tree. All their branches are cut away and the top of their trunk is grafted into the trunk of the tree below the upper edge of the wound. The old tree is thus provided with a new root system which enables it to survive.

759 - **The Fruiting of Trees in Consecutive Seasons.** — DUKE OF BEDFORD and PICKERING
S. U. *Fifteenth Report of the Woburn Experimental Fruit Farm*, pp. 1-19. London, 1916.

The view that fruit trees tend to bear heavily and lightly in alternate seasons is often made the basis of a recommendation to thin a heavy crop borne one year, in order to obtain a better crop the succeeding year. It appears, however, that the tendency towards alternate cropping, as it may be called, is very feeble, and that there is at the same time an equally potent tendency towards consecutive cropping, that is, that a tree bearing particularly well or badly during one season, will probably do the same in the succeeding season, whilst the chief factor in determining good or poor bearing is undoubtedly the atmospheric conditions, and not any innate tendency of the individual tree to either alternate or consecutive fruiting. The existence of a tendency towards alternate bearing is indicated by the fact that young trees, if prevented for four years from bearing after they have come to the age for so doing, will bear exceptionally heavy crops as soon as they are allowed to bear. But it was only in one series of experiments on some 300 young apple and pear trees during the seasons 1899 to 1903, that such a tendency was actually recognised. Observations on the same trees, made when they were younger, during 1894 to 1897, showed that their tendency then was towards consecutive bearing, and in another case of apple trees where the observations apply to over 5700 instances, extending from 1904 to 1915, the tendency has been, with only one slight exception, towards consecutive bearing. But this tendency affects the results to only a slight extent, about 12 per cent, the remaining 88 per cent being attributable to peculiarities of the season, and not to the individual behaviour of the trees. It is noticeable that the preponderating influence of external conditions becomes more marked as the tree is left more to its natural habits, *i. e.*, as it is less pruned, and, also, as the age of the tree increases; and it is more marked in the case of trees on the paradise stock than in these on the crab stock, this being doubtless a consequence of the latter coming less rapidly to full maturity than the former.

If, in a plantation consisting of a large number of individual trees, whether of the same or of different varieties, it is found that good and bad fruiting seasons alternate with each other, it is evident that such alternation must be caused by some conditions affecting all the trees alike and not to any tendency to alternate bearing exhibited by the individual trees; for such a tendency, if it existed, would be exhibited by different trees in different seasons, and the effect of it would be to bring about uniform production in the plantation as a whole. The alternation of good and bad years has been uniformly exhibited to a most marked extent in some plantations available for observation over a period of 20 years. As the

injury to these crops has nearly always been due to spring frosts, it is evident that the alternation of good and bad years is due to the tendency of such frosts to occur alternately in consecutive seasons.

60 - **New or Noteworthy Tropical Fruits in the Philippines.** -- WESTER P. J., in *The Philippine Agricultural Review*, Vol. VIII, No. 2, pp. 103-114, plates VI-IX. Manila, 1915.

It is pointed out that many tropical fruits might be grown much more widely than they are now, and attention is called to the following species, little known comparatively in the eastern hemisphere, or even in the Far East, except in the Philippines, and some of them quite new to fruit growers:

Antidesma Bunius Spreng. ("Bignay"). A member of the Euphorbiaceae, a native of Malaya common to the Philippines.

Dillenia philippinensis Rolfe ("Catmon"). Fam. Dilleniaceae, native and common in the greater part of the Philippines, but rarely cultivated elsewhere. The fruits, which are too sour to be eaten raw, are excellent when cooked.

Lansium domesticum Jack. ("Lansone"). Fam. Meliaceae, very much cultivated in the Philippines for the Manila market.

Eugenia Curranii Robinson ("Lipoti"). Fam. Myrtaceae, very probably native to the Philippines, rarely cultivated. Its fruit, too sour for eating raw, forms an excellent jelly.

Diospyros discolor Wild. ("Maholo"). Might be beneficially crossed with *kaki*, the fruit of which would give its aroma to the hybrid. The "maholo" would provide the plant with the means of adaptation to tropical climates.

Garcinia Mangostana L. ("Mangosteen").

Arclocarpus odoratissima Blanco ("Marang") and *A. elastica* Reinw. (Gomihan").

Sandoricum Koetjape (Burm.) Merr. ("Santol"). Fam. Meliaceae, native to Malaya yielding one of the best known fruits in the Philippines.

Garcinia dulcis Kurz. ("Baniti"). Fam. Guttiferae. This plant is only found wild in the Philippines. The fruit is of fine appearance and the pulp free from fibre. It is too sour and too lacking in sugar to be eaten raw, but forms an excellent preserve. Its composition is as follows:

Water	84.42 %	Invert sugar	2.64 %
soluble matter	6.78	Acidity (citric acid)	3.61
protein (N \times 6.25)	0.82	Ash	1.73

Canarium ovatum, Engl. ("Pili"). This member of the Burseraceae grows wild in some parts of the Philippines. It is not cultivated. Its nuts are very widely used. There is a form with long nuts (55 to 70 mm. and more), and another with shorter ones (45 to 60 mm). The chemical composition of their kernels is identical, as shown by the following Table.

Percentage Composition of the Kernels of the "Pili" Nut.

	Long Nuts	Short Nuts
Water	2.79 %	2.9 %
Fat	74.37	72.53
Protein (N \times 6.25)	12.06	11.88
Sucrose	0.88	0.66
Reducing sugars	0.45	1.35
Starch (by difference)	4.33	5.11
Crude fibre	2.15	2.42
Ash	2.97	3.15

761 - **The Brazilian Pitanga (*Eugenia uniflora* L.), an excellent Fruit Tree.**—

SHAMEL A. D. and POPENCE WILSON, in *The Journal of Heredity*, Vol. VII, No. 4, pp. 179-185, 2 fig. Washington, D. C., April 1916.

During their stay in the State of Bahia (Brazil), the writers frequently observed the "pitanga" in the regions occupied by citrus plantations. The "pitanga" cultivated as a tree (sometimes reaching a height of 33 to 39 feet), bush or hedge, yields a fruit resembling the cherry, but deeply lobed and with a much more distinct flavour.

The "pitanga" is native to Brazil, where it occurs widely. In the States of Rio de Janeiro, Parana, Santa Catharina and Rio Grande do Sul it occurs wild along streams and on the skirts of the forests. It is also cultivated in other States. The Portuguese long since imported it from Brazil to Goa. Outside Brazil its cultivation is very limited. It is met with in the following countries and localities: Botanical Garden of Saharanpur (British India), Ceylon, Hawaii, Algiers (where it is known as "Cayenne cherry" or "square cherry"), Cuba, Florida and California. In the two last countries, where the "pitanga" fruit is known as the "Surinam Cherry", it is little grown, but thrives wonderfully. The cultivation of the "pitanga" therefore appears to be possible wherever citrus trees thrive, and is capable and deserving of great extension.

Reproduction of the plant is by seed. The seedlings show much less variation than those of several long cultivated fruit trees. There being several different forms and marked varieties in each tree, the species should be greatly improved by selection.

The "pitanga" suffers greatly from frosts, but it has withstood temperatures of about -2.0° to -2.6° C. Although originating from a moist region, it is resistant to drought and prefers light, sandy, loamy or limestone soils.

The seeds germinate well if sown fresh. It is advisable to sow them in loose earth in pots inserted deep in a hot bed, replanting when the seedlings are about 4 in. high in pots in a warm bed, and to water frequently during the winter. Plants permanently planted out require no further special care.

The shortness of the period between flowering and ripening of the fruit should be noted: it is 3 weeks in Brazil, and 5 or 6 weeks in Florida. In Brazil the plants flower in September and yield a small crop in October. They again blossom for the principal crop in December or January. In

Florida the principal crop is gathered in March, with some late fruit up till May or June. Sometimes there is a second crop at midsummer. In California the crop is gathered in September or October.

Both in Brazil and Florida fructification is abundant and very regular when once the plants have attained a sufficient age, as they require several years to reach full bearing.

The Table shows the composition of the "pitanga" fruit cultivated at Hawaii:

Water	90.7 %
Dry matter	9.3
Dry matter insoluble in water	1.93
Acids	1.44
Protein	1.02
Total sugars	6.06
Fat	0.60

The fruits are eaten raw, or made into jellies, sherbet, liqueurs, syrups and wines regarded as medicinal (aperient and digestive). The leaves are widely used at Bahia for ornamental purposes.

62 - **Hybrid Direct Bearers in the Regions of Côtes du Rhône, France, in 1915.** —

DESMOULINS A. and VILLARD V. in *Le Progrès agricole et viticole*, 33rd Year, No. 10, pp. 228-234; No. 11, pp. 258-260; No. 12, pp. 274-279; No. 13, pp. 306-311. Montpellier, March 5, 12, 19 and 26, 1916.

The observations made in 1915 (16th year consecutive observations) are of peculiar importance, because of the exceptional virulence developed by mildew throughout almost the whole of the French vineyards. The different *Vinifera* suffered very badly.

The collection forming the basis of the writers' observations, and which increased year by year with the principal new products, is located in the valley of the Rhône, on essentially gravelly Alpine alluvial soil, without any limestone and containing numerous rounded pebbles. This soil, with medium fertility, is highly sensitive to drought and combines very favourable conditions for ascertaining the real value of the hybrids under observation, those with poor phylloxera-resisting powers suffer speedy deterioration. All the varieties observed are free stocks.

Two tables sum up the numerical results of the observations made in 1915. The first gives, for each variety observed, the age, colour of grapes, time of ripening, resistance of foliage and grape bunches to mildew, vigour, fertility, size of bunch, compactness of bunch, size of grapes, cultural particulars etc. The second table indicates the following, in respect to the different varieties the must of which has been analysed (62 analyses altogether): average weight of bunches, general health, bunches, day of harvesting, density of must, corresponding degree of alcohol, acidity of must.

A description is given of the hybrids which yielded the best results,

(1) For the observations in 1914, see *B.* 1915, No. 1301.

(Ed.)

and the direct bearing hybrids are then classified as follows from different points of view:

I. — CLASSIFICATION OF THE HYBRIDS ACCORDING TO THEIR RESISTANCE TO MILDEW IN 1915:

A) *Hybrids capable of dispensing with all spraying in normal years but which may receive one application to advantage, though such is not indispensable in wet years*: Couderc 7120 (the collection of which under observation dispensed entirely with spraying even in 1910 and 1915) 132-II, 142-26, 162-5, 162-97 — Seibel 438, 793, 867, 4995.

B) *Hybrids which may be left unsprayed in normal years without damage, though always receiving one application with benefit after flowering, and which in wet years require 2 applications for complete preservation*: Berthille Seyve 450, 618, 822, 872, 1129 — Caille 16 — Chevallerie 3401 — Castel 120, 315, 1028, 6239, 19422 — Couderc Baronne 2 503, 28-112, 106-38, 106-46, 106-51, 162-46, 171-56, 202-75, 226-58, 235-120, 272-60, 286-68, 299-35, 337-50 — Jurie 102 — Malègue 829-6 — Maureac 2 — Péage 1-18 — Perbos N° 1-46 and N° 6-53 — Seibel 1, 73, 82, 84, 128, 138, 209, 844, 858, 880, 1000, 1077, 2006, 2007, 2052, 2658, 2660, 2666, 2709, 2806, 2821, 2859, 4109, 4121, 4132, 4271, 4499, 4589, 4595, 4596, 4614, 4628, 4629, 4633, 4638, 4643, 4645, 4648, 4656, 4657, 4667, 4669, 4677, 4681, 4683, 4696, 4702, 4707, 4709, 4718, 4720, 4725, 4737, 4748, 4762, 4768, 4782, 4831, 4871, 4955, 4964, 4970, 4979, 4995, 5024, 5090, 5091.

C) *Hybrids requiring 2 sprayings in normal years, one before flowering and one after; and requiring additional application in years favourable to mildew*: Couderc-Baronne 4, 151, 156; Gaillard 157; Malègue 474-3; Péage 5-10, 5-17; Seibel 2653, 2655, 2686, 4111, 4151, 4271, 4433, 4461, 4591, 4615, 4636, 4662, 4716, 4767, 4951, 4969, 4973, 4989, 5061.

D) *Hybrids requiring nearly as many sprayings as the Vinifera*: Malègue 469-9, Seibel 4616, 4968, 4991, 4999, 5001.

II. — CLASSIFICATION ACCORDING TO THE INTENSITY OF COLOUR OF THE MUST:

1) *Hybrids with pink or light red must*: Couderc 202-75, Seibel 1000, 2859.

2) *Hybrids with ordinary red must*: Couderc 7120, 132-II, 162-97, 363-N, Seibel 1, 4271, 4268, 4643, Malègue 829-6, Berthille-Seyve 618, 822.

3) *"Teinturier" hybrids, with dark red must*: Couderc 106-46 (demi-teinturier); Seibel 128-2007, 2660, 4499; Berthille-Seyve 872-1129.

III. — CLASSIFICATION OF HYBRIDS ACCORDING TO THE NATURE OF THE SOIL IN WHICH THEY SEEM TO THRIVE BEST (the limestone factor is disregarded in this classification: in limestone soils grafting must be resorted to for hybrids not possessing sufficient resistance to chlorosis):

A) *Dry Soils*. — Can be planted out freely:

1) *1st period black grape*: Couderc 202-75, Seibel 1000, 2859, 4643, Berthille-Seyve 872, 1129.

2) *2nd period black grape*: Couderc 162-97.

3) *Black grape, end of 2nd or 3rd period of ripening*: Couderc 7120, 132-II, Berthille-Seyve 822, Seibel 4271.

- 4) *White grape, 1st period*: Couderc 272-60, 162-5, Berthille-Seyve 450
 - 5) *White grape, 2nd period*: Seibel 793, 858, 867, 4633.
 - 6) *White grape, end of 2nd or 3rd period*: Seibel 4595, 4762.
- B) *Medium Soils*. — Can be planted and cultivated free:
- 1) *1st period black grape*: Those mentioned for the dry soils plus: Seibel 128, Couderc 106-46, Seibel 4499, 4628.
 - 2) *2nd period black grape*: Couderc 162-97, Seibel 2007, 2660, Berthille Seyve 618, Malègue 829-6, Couderc 363-N.
 - 3) *Black grape, end of 2nd or 3rd period*: Those mentioned for the dry soils.
 - 4) *1st period white grape*: Those mentioned for the dry soils, and also: Castel 1028, Seibel 880, 4681 Gaillard 157.
 - 5) *2nd period white grape*: Those mentioned for the dry soils, and also: Castel 13706, Seibel 4657.
 - 6) *White grape, from end of 2nd or 3rd period*: As for the dry soils. and also: Seibel 4595, 4762.
- C) *Good Soils*. — Can be planted free:
- 1) *1st period black grape*: Seibel 128, 4199, 4628.
 - 2) *2nd period black grape*: Seibel 1, 2007, 2660, Berthille-Seyve 618, Malègue 829-6, Couderc 363-N.
 - 3) *Black grape, end of 2nd or 3rd period*: Couderc 7120, Berthille-Seyve 822.
 - 4) *1st period white grape*: Castel 1028, Seibel 880, 4781, Gaillard 157, Couderc 299-35 (Muscat du Moulin).
 - 5) *2nd period white grape*: Castel 13706.
- During their observations the writers found that the quantity of grape produced increased up to the 6th year of life of the hybrid, and then remained more or less constant.
- By resorting to grafting for hybrids also, their length of life is increased and the range of adaptivity and utilisation of the different varieties of hybrids is very much extended. The question, however, of affinity of the direct bearing hybrids with the principal grafting hosts is not very well known as yet. Save for a few exceptions, hybrids are generally good scions, especially for hosts of *Vinifera* strain (Franco-American), especially on the various *Rupestris* × *Vinifera*.
- 763 - **Observations on Direct Bearers at the Royal Oenological School of Conegliano, Italy.** — DALMASSO G., in *Rivista di Viticoltura, Enologia ed Agraria*, Year XXII, Series V, No. 4, pp. 57-62, No. 5, pp. 74-78, No. 6, pp. 90-92, No. 7, pp. 108-111, No. 8, pp. 127-129. Conegliano, February 15, March 1-15, April 1-15, 1916.
- These observations, made during the wine season of 1915, relate to the following hybrids: Castel 120, 1028, 3917, 4233, 5009, 6011, 6030, 6606, 7214 black, 7214 white, 13317, 13320; Couderc 101, 603, 84-3, 93-5, 1305, 4308, 4401, 74-17, 82-32, 106-46, 126-20, 126-21, 132-11, 198-21, 199-88, 267-27, 28-112, 746-51, 202-137; Seibel 1, 156, 1004, 1077, 2007; Alicante *Rupestris* Terras No. 20; Fourmié.
- The following hybrids showed the best qualities: Seibel, 1, 1077; Couderc 4401, 106-46; Castel 6606. All the last named gave a fairly abundant

production, an ordinary (red) table or semi-blending wine without foxy flavour, and of good quality. They also were found to possess great resisting powers to fungoid diseases. (The locality where the experiments took place being immune from phylloxera, it was not possible to test the resistance of the hybrids to this disease).

Among the mediocre hybrids, which are at any rate still worth keeping under observation, possessing some good qualities, the writer mentions: Castel 5009, 6030, 7214, 13317, 13320; Couderc 603, 4308, 96-32, 267-27, 746-51, 202-137; Seibel 156, 2007; Fournié. All of them yielded a sufficient or abundant crop of mediocre or even better quality, and a wine without foxy taste. They all proved very resistant to mildew and Oidium. Even in a year as unfavourable as 1915, both these last hybrids and those mentioned above remained perfectly healthy without any treatment being applied to them.

With the exception of Couderc 746-51 which has white grapes, all the hybrids mentioned as good or mediocre have black grapes. In the entire collection there was only one white-grape hybrid which was mediocre, Couderc 746-51. In addition, it has the defect that it yields a wine not entirely free from foxy taste.

764 - **An Interesting Problem in Connection with Radial Pruning.** — DALMASSO G., in *La Rivista di Viticoltura, Enologia ed Agraria*, Year XXII, Series V, No. 10, pp. 156-159. Conegliano, May 15, 1916.

Radial pruning has elicited interesting discussions as to the method of its application, and the question whether on each rod ("cordon") small

TABLE I. — *Riesling Italico* (hill).

Year	Production per vine Kg.		Sugar in must		Acidity of must		Ripening index	
	Small arcs shorter at base	Small arcs longer at base	Small arcs longer at base	Small arcs shorter at base	Small arcs longer at base	Small arcs shorter at base	Small arcs longer at base	Small arcs shorter at base
1911	4.35	3.46	19.30	19.65	—	—	—	—
1912	4.40	3.60	19.70	18.60	—	—	—	—
1913	5.95	4.66	20.40	19.75	9.80	9.75	2.08	2.02
1914	3.93	2.94	21.35	22.20	7.12	6.74	3.00	3.28
1915	2.37	3.05	22.30	6.56	6.56	6.18	3.40	3.83
Averages	4.20	3.54	20.61	20.78	7.83	7.56	2.83	3.04

TABLE II. — *Cabernet franc* (hill).

1911	7.222	5.410	19.00	18.40	—	—	—	—
1912	2.722	2.058	21.50	21.80	—	—	—	—
1913	5.000	2.850	20.53	20.28	9.25	9.25	2.21	2.19
1914	8.550	5.470	19.65	19.30	9.08	8.25	2.16	2.34
1915	5.830	4.600	21.40	20.05	7.87	6.90	2.72	2.99
Averages	5.865	4.077	20.41	19.96	8.70	8.13	2.36	2.47

unit-setting arcs of uniform length should be left or whether they should be longer at the base or at the end of the section, has not yet been solved. The Author, after reporting the different opinions of TRENTIN, SANNINO and STRADAJOLI, sets out the results of the trials carried out for the last years at the Wine School of Conegliano, in two vineyards situated in the upper part of the farm of that school. It is obvious from the two following tables, that for horizontal or slightly oblique radii it is advisable to leave the arcs at the base longer. The production per unit shows a marked advantage on the part of the arcs longer at the base, and this quantitative difference more than makes up for the slight detriment to quality.

55 - **Program for the Triennial Period 1915-17 arranged by the Swedish State Institute of Experimental Forestry** (Av styrelsen för Statens Skogsförsöksanstalt för treårsperioden 1915-1917 fastställt arbetsprogram). — *Meddelanden från Statens Skogsförsöksanstalt*, Part 12, 1915, pp. 58-60. Stockholm, 1916.

Following a meeting of the members of the governing Council and the professors of the Swedish High School of Forestry and of the Institute of Experimental Forestry, together with three specially summoned experts, the program of work to be followed at the Institute of Experimental Forestry has been sanctioned, with the right for the Institute to carry out minor investigations not laid down (1).

I. — THE QUESTION OF REGENERATION.

a) Seed investigations.

Investigations shall be begun for the discovery of the most suitable place for gathering cones and as regards the keeping of forest seeds (Forest Section). The biology of germination of the most important forest trees shall be studied, with special attention to the conditions of germination offered by the soil (Physical Section). The experimental plots for the investigation of the percentage of soil germination of the Norrland pine-seed shall be revised and the results prepared for publication (Forest Section). Existing means for testing seeds of various origins shall be revised when so required (Forest Section).

b) Special measures for securing natural regeneration.

In suitable places experiments by means of thinning in accordance with LAGNER's method shall be carried out (Forest Section), and in connection therewith the seed-producing capacity of forest margins of different composition shall be studied (Forest Section). The degree of regrowth in cleared lands shall be investigated in connection with their lie as to the points of the compass (Forest Section). The effect of brushwood burning and complete clearing of the soil shall be investigated with regard to the supply of nitrogen in the soil (Physical Section).

c) Measures of forest cultivation.

(1) As is prescribed in § 15 of the new Royal Instructions for the State Institute of Experimental Forestry (Cf. *Kungl. Maj:ts nädliga instruktion för Statens Skogsförsöksanstalt*; *Uttredning* Stockholm slett den 5 mars 1915). (Ed.)

The experiments instituted for the investigation of the most suitable time for sowing in Norrland shall be continued (Forest section). Existing experimental cultures with pine and spruce in various combinations shall be revised, if need be (Forest Section). The course of growth in the root of planted trees shall be investigated with a view to the discovery of the most suitable time for planting (Forest Section or Physical Section).

d) The problem of regeneration in special types of forest.

The investigations previously carried on concerning the difficulties of regeneration on the pine heaths shall be continued so far as is necessary to the completion of a report concerning this problem (Physical Section).

II. — PROCEEDINGS AS REGARDS THE COMPOSITION OF FORESTS.

a) Slight and extensive thinning operations.

Existing areas for slight and extensive thinning shall be revised necessary, and new areas shall be arranged so far as time permits, chiefly pine forests and spruce forests of low productivity and in spruce forest in Norrland of all grades of productivity, in the birch forests of Norrland in certain forests composed of aspen and oak, and in mixed coniferous forest (Forest Section). In the last named mixed forests there shall be arranged areas of young seedlands or plantations in order to throw light upon the way of raising forests of mixed composition (Forest Section).

b) Alteration of ground flora.

In some of the more suitable experimental areas for heavy thinning the ground vegetation shall be investigated in accordance with the RAE-KIAER method, as modified by LAGERBERG, in order to obtain fixed point for estimating the effect of the most thorough thinning upon the ground vegetation (Physical Section).

III. — DISEASES AND INJURIES OF FOREST TREES.

a) Diseases and injuries caused by fungi.

The occurrence and spread of the roots in the spruces whose tops were broken off during the winter of 1910-11 shall be examined (Physical Section). Moreover the roots of coniferous trees shall be taken up for closer investigation, with special attention to the conditions in the over-aged forests in Norrland (Physical Section).

b) Injuries caused by insects.

Investigations shall be instituted as regards injurious insects both in spruce cones and pine cones and in forest plants in nurseries. The extent of the increased ravages of bark beetles in certain districts shall be studied and at the same time knowledge of the known methods of effectively dealing with these last named insects should be spread amongst forest owners. In addition to this, should other insect ravages take place, studies should be instituted and advice given as to the checking of their ravages (Entomological Section).

IV. — RACES OF FOREST TREES AND THE SERVICEABLENESS OF FOREIGN FOREST TREES TO SWEDEN.

a) Race studies of spruce and pine.

Previous plantations of plants raised from selected seed shall be looked after so far as is necessary (Physical Section).

b) German spruce seed.

Existing stocks of plants of German spruce shall be used for the laying out of experimental areas, and the stock of plants shall be handed over to the superintendent of forest-districts ("revirs") with the request that they may be used in the forest cultures of the district (Forest Section).

c) Larch.

Further areas shall be laid out in larches, after which the results of the investigation into this kind of tree shall be prepared for publication (Forest Section).

V. — INVESTIGATIONS CONCERNING FOREST LAND.

a) Types of soil.

With a view to effecting a systematic survey of the different types of forest land in Sweden an investigation of the most important types shall be begun, in which attention shall be directed both to the genesis of the types and to their value from the standpoint of forestal productivity (Physical Section).

b) The genesis and improvement of degenerate forest land.

The studies of ling-heaths shall be continued in the same way as before with a view to summarizing the observations in a publication (Forest and Physical Sections).

c) Studies of the waterlogging of the forests in Norrland shall be continued in the same way as before and, so far as time allows, preliminary investigations shall be made concerning the waterlogging of forest land in the Southwest of Sweden (Physical Section).

d) The transformation of moss land to forest land.

Even if time is not available for the special investigation of this latter, yet attention should be directed to this problem when a suitable opportunity offers.

LIVE STOCK AND BREEDING.

56 - Injury to Livestock by *Simulium columbaczense*, in Hungary. — SCHMIDT M., in Állatorvosi Lapok (Veterinary Journal), Year XXXIX, No. 12, pp. 83-85; No. 13, pp. 89-91. Budapest, March 18 and 25, 1916.

In Hungary, the periodical outbreaks of *Simulium columbaczense* at times occasion exceedingly grave injury to cattle. Thus, in 1783, in Bats, there died from the bite of these insects: 52 horses, 131 cattle, 370 sheep and 130 pigs. In 1813 they killed 200 cattle in the neighbourhood

of Arad and 500 in the neighbourhood of Versecz. In 1880, 400 pigs, 80 horses and 40 cattle perished within 4 hours at Kevevara, and 100 cattle, 5 horses and 8 pigs in the "comitat" of Hunyad. Finally, in April 1915, the appearance of swarms of *S. columbaczense* caused widespread damage in the "comitat" of Temes alone, with a loss of 41 horses, 404 cattle, and 320 pigs. The places where outbreaks of *Simulium* occur are enumerated, with a description of the appearance of their swarms and the behaviour of domestic animals before and after the attack. This is followed by some clinical observations on the infection due to the bite.

Where large numbers of animals have been infected, there are many difficulties in the way of treatment, and prophylactic measures alone can be adopted. The writer employed the following method:

The flies were removed from the body of the animals by rubbing the skin with a clean cloth, after which the skin was washed with camphorated spirit. The animals were given 300 to 500 grams of brandy per head, diluted in water; in severe cases this dose was repeated a few hours later. Under similar conditions, other cardiac agents are to be recommended, and likewise the administration of purgatives to cure digestive troubles. Tumours were treated at the outset with subacetate of lead, but the results being negative a mixture of soap dissolved in alcohol and spirit of camphor with a little turpentine added was employed. Thanks to repeated friction with this and constant exercise (long runs) the tumours completely disappeared.

It being impossible to overcome the disease, the only thing to be done is to protect animals individually. When the flies make their appearance the animals must be kept in the stable, or if already out to grass they must be removed from the places visited by the insects. Since, however, local conditions do not always allow of adopting this course, the flies must be driven off by burning wet branches, dung or straw, or anything which will produce a dense smoke, to which the animals instinctively draw near. For animals used for draught or other work, a protective coat of oil or other fatty substance should be applied to the skin. The application of concentrated tar is not advisable. Valuable horses should be covered with fly nets and the stables built so as to keep flies out (fly flaps on doors and windows, or fire smoking in front of entrance).

The method of communication of the disease resulting from the bites of the *Simulium*, often assuming an acute form and causing sudden death, remains unknown hitherto. Microscopical analyses of the blood of the diseased animals and the spleen of the dead ones preclude any participation of bacteria or protozoa. Test animals inoculated with extract of *Simulium* remained free, which suggests that the extract possesses no toxic properties. Again, in the body of *Simulium* no micro-organisms were found. Nevertheless, animals attacked fall seriously ill within a few minutes, and often die within half an hour, although death from asphyxia is very rare, as was proved by a post-mortem of dead or slaughtered animals. In all the animals attacked, however, the Author observes some symptoms of nervous derangement, such as diminution of sensitiveness, general torpor,

uncoordinated movements and blindness. These symptoms, as well as those of the heart (rapid palpitation) prove that *S. columbacense* injects some toxic substance which reaches the nervous system and paralyses the nervous centres of the medulla oblongata; during this process the modification in the circulation causes tumours on the soft part of the larynx, which hinders respiration.

The Author suggests that further extensive experiments be undertaken with the blood of diseased animals, and the pathological changes of the nervous tissue, if any, be studied.

The meat of slaughtered animals is quite harmless to man. To facilitate control, herdsmen should, before the *Simulium* appear, be made acquainted with various protective means and recommended to destroy severely attacked animals before death occurs and to bleed them thoroughly.

767 - **The Possible Passage of Trypanosomes into Milk.** — LANFRANCHI ALESSANDRO, in *Atti della Reale Accademia dei Lincei*, 5th Series, *Rendiconti*, Vol. XXV, Part 5, 1st Half Year, pp. 369-373. Rome, 1916.

Work carried out at the Institute of Pathology and Clinical Medicine of the Royal University of Bologna.

Several writers have shown that a large number of trypanosomes are able to pass through the different mucous membranes, and NATTAN LARRIER has already taken in hand the solution of the problem of trypanosomes passing into milk. The result was affirmative as regards *Tr. schizotripanum* Cruz, and almost always negative for *Tr. equiperdum*. The writer next describes his experiments with the trypanosomes *Brucei*, *Evansi*, *rodesiense* and *gambiense*.

The virus was injected into the veins of bitches which had just littered. It was desired to find: 1) whether the young when allowed to suck were infected; 2) whether the presence of trypanosomes could be detected by direct examination of milk; 3) whether the milk when inoculated into the peritoneum was able to infect rats or mice.

From the results it is concluded that:

1) The passage of the trypanosomes *Brucei*, *rodesiense* and *gambiense* into milk is possible.

2) The infection with the virus of *Brucei* and *gambiense* can be transmitted by suckling.

68 - **Enquiries and Experiments in connection with the Immunity of Cattle against Epizootic Foot-and-Mouth Disease.** — TERNI CAMILLO, in *La Clinica veterinaria*, XXXIXth year, No. 9, pp. 257-261. Milan, May 15, 1916.

The results obtained in the investigations and tests carried out at the "Stazione sperimentale per le malattie infettive" of Milan, confirm those which had previously been obtained by Messrs. COSCO and AGUZZI (1) and lead to the following conclusions:

1) The virus is preserved indefinitely by means of its successive passage through animals susceptible to the disease, when blood products (se-

(1) See B. June 1916. N° 661.

rum and red globules) are used in the same way as with the products of local lesions. The best method for preserving its virulence and observing its infective power in those tissues where the disease arises preferentially under natural conditions, is that of *inoculating into the tongue* infective material or blood taken from the animal during a period of fever exceeding 40° C., or the product of local lesions. The maximum virulence is produced by passing through the epithelium of the digestive apparatus (tongue or paunch).

2) The virus obtained in this way, whether fixed or temporary, represents the maximum intensity of virulence both in infective and spreading power, the adult animal falling sick in 24 to 36 hours. It almost always kills young animals, especially when not yet weaned (calves, lambs, kids or sucking pigs), by general infection, the virus being constantly present in the blood.

3) The present experiments would appear to show that several kinds of animals are capable of containing in their blood for some time a very virulent virus of foot-and-mouth disease, without specific external symptoms or with merely slight lesions of the mucous membrane of the digestive apparatus or the pad of the short pastern.

4) With the blood products kept in a thermostat, or cold, until the virulence is exhausted, it is possible to create a resistance to foot-and-mouth disease in animals, which will allow of making successive inoculations of living virus, and of obtaining a much higher degree of immunity as compared with animals which have overcome the disease in a serious form (38 months of observations on a group of 20 cattle).

5) Similarly it is found that the serum of the blood of cattle which have passed beyond the febrile stage of the disease is of marked curative and preventive efficacy against even a malignant form of virus. The inoculation of the blood as such or of serum, under these conditions (containing the maximum of antibodies), is a sure preventive of the death of adult animals, and results in their speedy recovery. A therapeutic system in the cowshed or cattle-pen is therefore practically possible, if serum be taken from recently cured animals and injected into those most seriously ill. In this connection, the haemovaccination advocated by PERRONCITO also possesses an acceptable practical basis.

6) In foot-and mouth disease, 2 forms of immunity are distinguished, one general, which is located in the blood and more particularly in the white globules (preferentially eosinophiles), the red globules and the plasma; the other of a more strictly histogenic character and involving the protective epithelia of the digestive passages. The latter is less lasting than the immunity located in the blood, and is strictly related to the wear and regeneration of the epithelial cells. In cattle, by means of *injection into the tongue*, it is found that the gradual loss of immunity begins with the *epithelium of the tongue*, followed by that of the rumen and the small intestine, and the mucous membrane of the hoof pad.

Thus, as happens under natural conditions, there may be animals presenting serious external symptoms, involving chiefly the epithelium of the

the tongue, while the virus does not pass into the blood, which still retains a sufficient degree of immunity to prevent general infection, or else it enters the blood for a very short time and in an attenuated form only. These are the cases when the feverish reaction does not take place or only amounts to a few tenths of a degree for a brief period.

The clinical forms of foot and-mouth disease (external, internal or malignant) are in direct relation with the fluctuations in the degree of immunity existing in the local tissues and the blood. When the animal has never had the infection, or has completely lost the internal or local immunity produced by a previous attack of the disease, the slightest injury to the epithelium of the tongue and the rumen (for instance, injuries caused by the heads of rye-grass, in the presence of the virus) suffices to produce a first focus of the disease, which in a few hours causes the infection of the blood, marked by the onset of fever. When on the other hand, as frequently occurs, after an attack of foot-and-mouth disease, some degree of immunity still continues in the blood, the seat of disease involving one or more points of the epithelium of the entrance to the digestive passages remains localised but the virus may, in this first passage, acquire an increase of infective activity for other susceptible animals.

7) Therefore, in the production of immunity against the malignant virus of the disease, *i. e.* the one with the maximum of infecting and spreading power, the writer preferred to combine the products of local lesions with those of the blood in order to utilise the substances elaborated by the virus in the tissues for which it exhibits a preference, and obtain an enhancement of local histogenic immunity in order to secure a lasting and sure prevention of external lesions. The latter, even if slight, may have serious consequences, owing to the occurrence of secondary symptoms or the spread of the virus through the body.

In the lesions of the epithelium, substances are observed which may be termed *granulo-stimulines* and *granulo-lysines*, inasmuch as they exert, as a specific character, in the first place a positive chemiotaxy for the leucocytes with eosinophile granulations, and afterwards a lithic action, which results in an infiltration of the eosinophile granulations into the tissues of the sick animal in direct ratio to the gravity of the infection. The character of immunity is indicated by the cessation of the process of dissolution of the eosinophile cells.

8) In animals which have died from foot-and-mouth disease at a late period, the virus may also not be present in the blood, but is found localised in various organs, especially in the cardiac muscle, the brain, the liver and the kidney, less frequently in the spleen or the marrow. When the virus is in the blood it is chiefly found in the venous blood, being in the greatest amount and virulence in the portal vein.

The bulk of the virus is eliminated from the blood through the kidney. Its elimination also occurs, though in a lesser degree, through the milk and the saliva. In the majority of cases these only become infectious owing to the products of local lesions. It can even be shown that the

action of the saliva tends to attenuate the virus, while, in the urine, its virulence is long maintained unaltered (1).

769 - **Osmotic Equilibrium between Blood and Milk in the Cow.** — VAN DER LAAN, F. R. in *Biochemische Zeitschrift*, Vol. 73, Nos. 5-6, pp. 313-325. Berlin, April 4, 1916.

The writer's previous experiments (2), in relation to osmotic concentration of the blood, milk and bile in the cow, have shown that the value of the three concentrations is the same, even if the osmotic concentration of the blood is artificially modified. These experiments, however, having all been made with healthy animals, the concentration in sick animals still remained to be studied.

It has been ascertained that in man certain diseases, chiefly those of the heart and kidneys, produce a great increase of osmotic pressure in the blood, owing to derangements of metabolism. Doctors therefore ascertain the freezing point of the blood of their patient when they wish to find out whether one of the kidneys or both are diseased.

The writer used this method for studying the osmotic concentration of the blood in 8 cows suffering from : toxemia, constipation, chronic peritonitis with acute enteritis, pyelonephritis, loss of blood through perforation of the rectum, tuberculosis (2 cases), fracture of the ileum. With this object he determined the freezing point of the blood, the milk, and in some cases the bile. The investigations showed that the freezing point of the blood and milk are not modified by the disease. In one case only the osmotic pressure of the blood was increased owing to auto-intoxication, but the osmotic pressure of the milk had undergone a corresponding increase. The Author mentions in this connection an experiment made by PLIESTERS on a cow suffering from anthrax (splenic fever), which gave a similar result.

In spite of the small number of cases observed, it is believed that the diseased condition can only increase and never reduce the depression of the freezing point of the blood of the cow. In most cases the disease will not

(1) The question dealt with here is, as it were, the crux of the problem of immunity, not only in respect to foot-and-mouth disease, but also to other infectious diseases with filterable virus located in the blood. Thus, for instance, in cow-pox just as in foot-and-mouth disease by passage through hypersensitive animals, a virus of special infective activity to the blood can be produced. In that case cutaneous inoculation of the blood or its components separately produces the characteristic pustules even in man. By using this intensified virus a widespread eruption is easily caused in man (4 cases out of 12 inoculated), but the virulence is reduced if the blood is kept on glass for a given period, in the presence of oxygen.

In comparative studies of cow-pox and foot-and-mouth disease, the writer found that the two viruses behave similarly as regards local and general immunity. In some cattle which had been inoculated with positive results more than 7 years since, he observed that the immunity persisted as regards cutaneous inoculation or quite temporary reactions alone were produced, while when inoculated on the mucous membrane (tongue) characteristic pustules were obtained, but then the virus did not pass into the blood. If, on the other hand, young animals are used which have never been infected (preferably meadow-fed, as then less liable to contagion than those human vaccination), whatever the channel of entrance, the virus passes into the blood and continues present there during the febrile period.

(2) See B. 1915, No. 1314.

exercise any influence on the absolute freezing point of the blood and the milk. For practical milk testing this fact is very important, as the lowering of the freezing point of milk is often justified on the ground that it comes from a diseased cow:

The osmotic pressure of the milk, and in some cases of the blood, was also studied in several cows with a diseased udder. Most of the animals had streptococcal mastitis, the mastitis being of a tuberculous nature in some cases only. Experiment proved that the milk was of very abnormal composition. The diseased teats regularly gave an abnormal milk quite different from the normal.

The lactose had generally disappeared, and the content of ash and chlorine corresponded to that of the blood serum. In spite of all these anomalies, however, the freezing point of the milk was always normal, except in one case where the animal was very ill owing to auto-intoxication. The blood of the cows yielding this milk had a lower freezing point than that of the blood of healthy animals, but it corresponded exactly to that of the milk. These experiments therefore show that the worst forms of mastitis cannot affect the osmotic concentration of the blood and milk in cows.

The fact that as the mastitis develops the composition of the milk resembles that of the blood serum more and more, has been explained by the hypothesis that the process of secretion is gradually replaced by one of filtration. It is a point in favour of this view that the freezing point is not modified by the disease, because the filtered product (milk) has the same freezing point as the blood of the same cow.

From the fact that mastitis does not modify the equilibrium between the osmotic concentration of the blood and that of the milk, it is inferred that milk from the diseased teats must have the same freezing point as from the healthy ones. Experiment proved the correctness of this view.

By another series of experiments it was demonstrated that in cases of mastitis the depression of the freezing point of milk remains unaltered so long as the disease is not followed by general intoxication increasing the osmotic concentration of the blood. This seems to contradict the results obtained by the other investigators. The writer believes that the depressions observed by several investigators in the milk from a diseased teat was due to detritus, etc. mixed with the milk in question.

The cream has the same freezing point as the corresponding skim milk.

The depression of the freezing point, both in milk from healthy and from diseased udders, is never less than 0.53 C.

10 - **Grain Screenings and Results of Feeding Experiments in Canada.** — DYMOND J. R., ARCHIBALD E. S., and ELDORF F. C., in *Dominion of Canada, Department of Agriculture*, 14 pp. 8 tables, Ottawa, 1913.

Cereal growing has rapidly increased during the past few years in the prairie region of Canada. As a result of the system of continuous cultivation, the crops contain a noteworthy proportion of foreign seed. In the year ended 31st August 1913, the Inspection Service of the Cereals Commission of the Department of Commerce recorded the presence at the central mills of more than 100 000 tons of screenings of wheat, oats, barley and lin-

seed. It is calculated that the costs of carriage of this material from the fields to the silos amounts to 650 000 dollars. It contains empty or broken seeds of wheat, oats, barley and flax, with variable proportions of a large number of weed seeds. The greater part is exported to the United States where it is screened once more for the production of different cattle feeds.

Owing to the extreme smallness of the seeds of certain weeds, and the hardness of some others, they cannot be crushed by the ordinary grinding machinery. Special plant is required, which is expensive in cost and operation, for the purpose of thoroughly grinding all impurities. If screened again through a zinc screen with meshes of 1.8 mm so as to separate the very smallest weed seeds, which are called black screenings, crushing can very well be carried out with ordinary grinding machines, if the screening and crushing are carefully done. This gets rid of about 40 % of the ordinary screenings.

It must be remembered that feeds manufactured with screenings not properly cleaned may contain thousands of live weed seeds per pound. Feeds of this kind should not be given to cattle, as this might promote the spread of weeds to the extent of causing thousands of dollars worth of damage.

The feeding experiments carried out with cows in milk, pigs, lambs and chickens, showed that the blank screenings are valueless as a food and are also expensive owing to the adulteration which they cause. When mixed in considerable proportions with another food they render it distasteful to all livestock. Although by adding molasses to crushed screenings containing their share of black screenings the food is rendered appetising, it is not economical. In short, the cheapest way of rendering screenings palatable to remove the black seeds.

The screenings, with their black part eliminated, may be given without restriction to horses, cattle, sheep or pigs. It is preferable, however, that they should not form more than 50 to 60 % of the total grain ration. Buck wheat screenings are particularly suited as food for poultry, but it is dangerous to give the latter linseed screenings.

As the makers of threshing machines all claim that their machines are or can be, fitted with screens which are able to separate a large portion of the waste in threshing, the Authors are of opinion that, if greater care were taken in separating the grain during threshing, it would not only save the cost of transport of the impurities, but the farmer would in this way be provided on the spot with a very useful feed which he could employ directly on his farm or sell to breeders. It should, however, be pointed out that weeds cause enormous losses to farmers every year, so much so that though it is desirable that everything of value as a food, such as screenings, should be turned to account, it would be preferable to burn them rather than use them in a way which might help the growth of weeds.

To sum up, from the practical point of view, the black screenings must be separated from the others and burnt, as they only reduce the nutritive value of the other screenings comprising bigger seeds. They also form a danger with regard to the spread of weeds. They have an appreciable fuel

value; they chiefly represent seeds of *Chenopodium album* L. and Cruciferae rich in oil, which it might be profitable to burn after mixing with coal.

71 - **Spotted Asses.** — JENKS ALBERT ERNEST, in *The Journal of Heredity*, Vol. VII, No. 4, pp. 165-168, 2 figs. Washington, D. C., April 1916.

Wild specimens of domestic breeds, and the wild species most nearly related to domestic animals, are spotted in a typical or specific way, but it is rare for these markings to be white. On the other hand, domestic and pet animals show white spots in almost all species. This white spotting, however, has rarely been reported up to the present for the Asiatic elephant (*Elephas indicus*) and the dromedary (*Camelus dromedarius*.) The writer never found it reported of the donkey in the literature of the subject. He therefore describes some cases of white spots on a grey coat or black on a white coat which he observed in the United States (Arizona) and in Italy (Naples and environs). It should be noted that the 3 species rarely spotted white, namely the elephant, the dromedary and the ass, have been much less subject to selective breeding than the majority of the other domestic species. They exhibit only a small number of breeds. This confirms the idea that hybridisation by selection is an important factor in the formation of white spots in domestic animals.

72 - **The "Miranda" Breed of Cattle (Braganza, Portugal).** — CRUZ SHEPHERD, in *Revista de Medicina Veterinaria*, 14th Year, No. 168, pp. 351-360, Lisbon, February 1916.

The special environmental conditions of the place of origin of the Portuguese "Mirandesa" breed of cattle, namely, isolation and scarcity of forage, have imparted great purity to it, together with the characteristic of furnishing particularly fine working animals. Together with the "Brava", "Landaise", "Charolaise" and "Sicilian" breeds, it forms the Iberian stock, originating from *Bos primigenius*. From it there have been derived by progressive adaptation to different environments, the sub-races 1) "Braganza"; 2) "Beira"; 3) "Mirandes estremenho" or "Ratinho serrano" which form almost the whole of the cattle stock of Estremadura; and 4) "Jarmelo", a breed specially noticeable for its excellent milk-producing capacity.

By improving the pasturage, it will be easy to make the "Mirandesa" breed excellent for meat and milk production, in addition to its working powers. Cattle of this breed are now being exported in large numbers to Spain, where they are fattened for slaughter. Their principal characteristics are: straight profile of head, straight medium sized horns, neck short and thick, chest wide, very high and deep, shoulders muscular, back slightly arched, rump higher than the withers, paunch regular, hips projecting, insertion of tail, limbs long bony, often badly balanced, coat chestnut more or less dark, with a light yellow strip along the line of the back, from the withers to the base of the tail and darker in the bull than in the cow.

- 773 - **Feeding Cows with the Subcutaneous Matter of Skins intended for Tanning Experiments in Germany** (1). -- GERLACH, in *Deutsche Landwirtschaftliche Presse*, 43rd Year, No. 26, p. 229. Berlin, March 29, 1916.

For his feeding experiments the Author used a subcutaneous material ("Leimleder", glue leather i. e. leather cuttings containing gelatinous matter), at present sold in Germany under the inappropriate name of "Baden meat meal" and containing, according to the analysis made by him, 14.72 % of water, 55.77 % of crude protein, 12.35 % of fat, 10.06 % of mineral matter. The crude protein is a mixture of albuminoids (chiefly collagen), pure proteins and amides, being substances soluble in the gastric juices of animals.

As test animals there were used 9 milch cows between the 2nd and 3rd month of the lactation period. They were given as basal ration per 1000 kilograms live weight per day: 5 kg. chopped forage, 4 kg. hay, 20 kg. beetroot leaf silage, 15 kg. mangolds, 20 kg. potatoes, 1.5 kg. wheat bran, 1 kg. of lupins with the bitter taste removed. The starch value was 10.3 kg; the quantity of pure digestible protein was 1.1 kg. As cows which have just calved must usually receive 1.6 to 1.9 kg of pure digestible protein and a starch value of 9.8 to 11.2 kg, the basal ration lacked 45 to 73 % of the first element, while the starch value was fairly large. To make up the deficiency there was added to the basal ration, for one group 3 kg. of linseed cake and for the other 1.5 kg. of glue leather. The animals at once took to the latter.

The experiment, which was begun on the 20th January, was intended to continue until the 28th February. During that time the milk secretion was 10 % less in the glue leather group, but the milk was a little richer in fat.

The difference between the production of the two groups being small, the experiment was continued until the 23rd March. The group which at first received glue leather was then given linseed oil cake, and vice-versa. During this second period, the cows receiving glue leather gave somewhat more abundant and more fatty milk; this increase in the percentage of fat was also observed in the first period.

Assuming that the linseed cake caused the production of 100 parts of milk and 100 parts of fat, the glue leather produced 98 and 102 parts respectively.

In conclusion, glue leather is recommended as a good concentrate for cows in milk.

- 774 - **Skim Milk with an Addition of Sweetened Flour for Rearing Sucking Calves.** -- EDIN HAROLD in *Kungl. Landbruks-Akademins Handlingar, och Tidskrift*, Year IV, Nos. 1-2, pp. 83-120, Stockholm 1916.

In Sweden, 1 700 000 calves are produced annually of which only 400 000 are reared, the others going to the butcher. The majority are sold shortly after birth, when the meat has not yet "set" and the price is always low, not exceeding 19s. 7d. per cwt. live weight.

(1) In connection with the use of this substance in pig feeding, see *B.*, 1915, No. 1961. (*Ed.*)

During the period 1912-1914, a series of experiments were carried out at Knistad, in order to ascertain whether skim milk with sugared flour added to it can suitably replace full cream milk, so as to rear the calves with advantage until, in consequence of the improved quality of the meat and increased weight, they are better suited for the market. The food mixture prepared as follows :

To 22 lb. of oat flour, mixed with wheat, rye or maize flour there is added 3.3 galls. of skim milk and 3.3 galls. of water. The whole is heated and when it begins to boil, the pan is taken off the fire and the contents allowed to cool to 60° C, after which very fine powdered sugar is added in the proportion of $\frac{1}{10}$ of the flour (in this case 2.2 lbs.) mixing thoroughly until the mass, which becomes thinner, is uniformly sweetened. Finally, 4.4 galls of skim milk are added.

During the experiments results clearly positive in character were obtained :

1) Skim milk with sugared flour added can take the place partly, and subsequently entirely, of full cream milk, without any disadvantage to the normal growth of the calf, the quality of the meat alone becoming slightly inferior.

2) The best results are obtained by mixing the flour with skim milk in the proportion of one lb. to 2 gallons of milk; greater concentration produces digestive trouble.

3) How far it is desirable to prolong this form of artificial feeding is a matter which of course varies from place to place according to the price of meat and the cost of the feed substances used.

Other experiments carried out at Biärka-Saby (Alberga) and at Gedeholm confirm the results already obtained at Knistad.

75 - **Experiments to ascertain whether the Ability to produce Milk-fat is transmitted by the Dam or the Sire.** — WOODWARD T. E., in *Hoard's Dairyman*, Vol. LI, No. 4, p. 146, Fort Atkinson, Wis., February 18, 1916.

In carrying out the investigations to solve the above problem, the Advanced Registry of the American Guernsey Cattle Club was utilised.

The plan was to take the bulls having Advanced Registry daughters and pick out those daughters which had different Advanced Registry dams. When a difference was found between the daughters it must be attributable to the dams, since the sire would remain the same in each case. When 10 daughters were found by the same bull, the higher and the lower producer were compared. When three daughters were found, the highest and next were compared and the third discarded; and when four were found 10 comparisons were made possible. In every case an even number of daughters was used, except when two or more had the same dam, in which event the records of all out of the same dam were averaged and treated as by one animal.

A total of 384 daughters having tested dams was found, which allowed 192 comparisons. In 110 cases out of 192 (57.3%) the high producing daughters were from dams with the higher records. The average fat production is as follows :

	Pounds
192 low producing daughters	435.88
192 high producing daughters	548.10
Dams of low producing daughters	473.50
Dams of high producing daughters	500.57

The influence of the dam on fat-production is evident. Compiling the data in another way, we have :

	Pounds
192 low producing dams	428.07
192 high producing dams	546.22
Daughters of low producing dams	482.86
Daughters of high producing dams	500.61

While there is a difference of 118 pounds of fat between the high and low producing dams, there is a difference of only 18 pounds between the daughters. This indicates that the sire also has something to do with the inheritance of dairy quality.

By dividing the dams into two groups, regardless of the bull to which they were bred, placing in one group all cows producing 500 lbs. or more and in the other all producing under 500 pounds, we have the following :

Number of dams producing 500 pounds or more	132
Number of dams producing less than 500 pounds	252
	Lbs. fat
Average of high producing dams	509.05
Average of low producing dams	428.33
Average of daughters of high producing dams	532.87
Average of daughters of low producing dams	476.18

All the methods of comparison strongly indicate that fat-producing ability is inherited from the dam as well as from the sire, and that the practice of retaining heifer calves from the best cows for replenishing and building up the herd is sound. The fact, sometimes observed, that with poorer quality cows and selected bulls high producing daughters have been obtained, must be chiefly considered as an exception which should not be made the basis in the selection of dairy cows for increased milk production.

776 - List of Champion Cows of the 5 Principal Dairy Breeds of the United States in 1915. — *Hoard's Dairyman*, Vol. II, No. 4, p. 143. Fort Atkinson, Wis., February 18, 1916.

On the 1st January 1916 the cows in each breed yielding the highest semi-official yearly records in the United States, as communicated by the Secretariates of the several breeding associations, were as follows :

Ayrshire.

Class	Name	Milk — lbs.	Fat — lbs.
5 years old and over	Garclaugh May Mischief	23,329	894.30
	Lily of Willowmoor	22,596	955.56
4 $\frac{1}{2}$ to 5 years	Miss Nox 3d	15,015	576.94
4 to 4 $\frac{1}{2}$ years	Agnes Wallace of Maple Grove	17,657	821.45
3 $\frac{1}{2}$ to 4 years	Elizabeth of Juneau	15,122	536.15
	The Abbess of Torr	14,582	640.72
3 to 3 $\frac{1}{2}$ years	Ethel of South Farm	15,056	589.20
2 $\frac{1}{2}$ to 3 years	Henderson's Dairy Gem	17,974	738.82
2 to 2 $\frac{1}{2}$ years	Jean Armour 3d	14,987	599.91

Brown Swiss.

Class	Name	Milk — lbs.	Fat — lbs.
Mature	College Bravura 2nd	19,461	798.16
Five-year-old	Rosalind B.	16,804	727.64
Five-year-old	Ethel B.	17,543	710.99
Four-year-old	Merry of Allynhurst	14,371	578.87
Three-year-old	Hundry	14,087	574.52
Three-year-old	Ha B.	15,003	548.92
Two-year-old	Elsie of Lake View	13,149	486.97

Guernsey.

Class	Name	Milk — lbs.	Fat — lbs.
5 years old and over	Murrie Cowan	24,068	1008.18
4 $\frac{1}{2}$ to 5 years	Dairymaid of Pinchurst	17,288	910.67
4 to 4 $\frac{1}{2}$ years	Azcena's Price 2d	16,204	855.70
3 $\frac{1}{2}$ to 4 years	Dolly Dimple	18,459	906.89
3 to 3 $\frac{1}{2}$ years	Johanna Chene	16,187	863.36
2 $\frac{1}{2}$ to 3 years	Langwater Hope	15,079	773.59
2 to 2 $\frac{1}{2}$ years	Cherry of Edgewater	15,454	732.97
	Marshall's Lady Dudley	14,814	606.46

Holstein-Friesian.

Class	Name	Milk — lbs.	Fat — lbs.
5 years old and over	Duchess Skylark Ormsby	27,761.7	1205.09
5 years old and over	Tilly Alcartra	36,451.4	951.23
4 $\frac{1}{2}$ to 5 years	Lucile Jolie Pontiac	23,830.2	938.52
4 $\frac{1}{2}$ to 5 years	Irma Gilt Edge Queen 2d	26,745.3	758.88
4 to 4 $\frac{1}{2}$ years	Daisy Grace De Kol	21,718.3	962.80
4 to 4 $\frac{1}{2}$ years	Queen of the Hengervelds	23,788.1	702.46
3 $\frac{1}{2}$ to 4 years	Duchess Hengerveld Komdyke	22,807.0	903.38
3 $\frac{1}{2}$ to 4 years	Friend Echo Elmore	23,148.6	732.70
3 to 3 $\frac{1}{2}$ years	Finderne Holingen Fayne	24,012.8	1116.05
2 $\frac{1}{2}$ to 3 years	K. P. Manor Kate	22,106.4	818.73
2 to 2 $\frac{1}{2}$ years	Finderne Mutual Fayne	21,150.4	660.51
2 to 2 $\frac{1}{2}$ years	Elmside Nadine Segis Johanna	22,802.3	706.40
Under 2 years	Woodcrest Colantha Pietje	20,850.7	636.02

1000

PIGS

Jersey.			
Class	Name	Milk lbs.	Fat lbs.
5 years old and over	Sophie 19th of Hood Farm	17,557.7	994.1
5 years old and over	Passport	19,694.8	839.5
4 $\frac{1}{2}$ to 5 years	Olympia's Farm	16,147.8	937.8
4 to 4 $\frac{1}{2}$ years	Lass 64th of Hood Farm	13,444.6	817.5
4 to 4 $\frac{1}{2}$ years	Flying Fox's Maid	14,315.6	788.5
3 $\frac{1}{2}$ to 4 years	Lass 66th of Hood Farm	17,793.8	949.5
3 to 3 $\frac{1}{2}$ years	Lass 74th of Hood Farm	13,713.9	747.6
3 to 3 $\frac{1}{2}$ years	Lucky Farce	14,184.8	797.3
2 $\frac{1}{2}$ to 3 years	Lad's Lady Riotress Irene	12,307.8	666.5
2 to 2 $\frac{1}{2}$ years	Pearly's Exile of St. Lambert	12,345.5	810.4
2 to 2 $\frac{1}{2}$ years	Lass 66th of Hood Farm	14,513.1	720.3
Under 2 years	Lucky Farce	14,260	675.8

777 - **The Guernsey Breed of Cattle in Italy.** -- BARTOLUCCI A., in *L'industria lattiera e casearia*, XIVth Year, No. 5, pp. 68-69 (No. 8, pp. 117-119; 7 fig. Reggio d'Emilia, March 1st and April 15, 1916.

One of the first attempts at introduction and acclimatisation of the Guernsey breed in Italy was made by COUNTESSINI at Grottaferatta, province of Rome, on a farm rich in forage and possessing byres containing all up to date improvements. The imported specimens, male and female, as well as the pure products, have retained all the original characteristics, as well as capacity for milk production, the organoleptic characters, and the composition of the milk and butter. The pure progeny have been selected and crossed with cows of the Lombard, Brown Swiss and Dutch type. It has thus been possible to prove the preponderant character of the Guernsey bull in transmission by inheritance. In all the cases, the milk production of the females obtained from these crosses was larger and better than that of their dams.

778 **Experiments in Pig Feeding with Potato Peel.** -- ZUNTZ and VON DER HEIDE, in *Deutsche landwirtschaftliche Presse*, 43rd Year, No. 31, p. 276. Berlin, April 15, 1916.

The Authors carried out 2 experiments at the Physiological Institute of the University of Berlin in feeding pigs with potato peel in the form of Berlin kitchen refuse.

In the first experiment, this peel, well dried, then coarsely ground, was administered with a basal ration to 3 pigs. It was found that pigs of a weight of 66 to 88 lbs can easily take 1.1 lbs. of dried peel per day per head.

A second experiment, in which 1 pig received 1.1 lbs. of potato peel and 0.22 lbs. of desiccated full cream milk per day, and was put into a respiration chamber, showed that the crude cellulose of the peel is much less digestible than that of the whole potato, which is quite intelligible. This matters little, however, because the content of crude cellulose is small relatively to the other nutritive elements, and the content of non-nitrogenous extract is almost equal to that of whole dried potatoes. The crude protein is difficult to digest, but the figures of digestibility are not much below those found by KELLNER for dried potatoes.

In conclusion, the food value of the peel equals 80.6 % of the potato substance. The disadvantage of the peel is that the animal will not take it in large quantities for a sufficiently long period, the result being that few proteins are formed in their bodies.

9 - **Experiments in Feeding Pigs with Straw Meal and Straw rendered Soluble by Caustic Soda.**—SCHNEIDEWIND, in *Landwirtschaftliche Wochenschrift für die Provinz Sachsen*, 18th Year, No. 7, pp. 57-59. Halle a. S. February 12, 1996.

The straw made soluble by a solution of caustic soda used in this experiment, first manufactured in Germany by OEXMANN and sold under the name of "Zellulosefutter" (cellulose forage), generally contains 65 % of the ligneous substance, 20 % of dried potato, and 15 % of molasses. The straw meal, finely ground cost 12 s. per cwt. The two forages were compared with sliced potatoes.

The test animals were 12 growing pigs divided into 4 equal groups, divided as follows:

Group I	{	Crushed barley, first 2.2 lbs.; afterwards 3.3 lbs.
	{	Boiled potatoes 10.8 lbs.
	{	Fish meal, 1.5 lbs.
Group II	{	Crushed barley, first 2.2 lbs.; afterwards 4.4 lbs.
	{	Sliced potatoes, 6.6 lbs.
Group III	{	Crushed barley, first 2.2 lbs.; afterwards 4.4 lbs.
	{	Cellulose forage, 6.6 lbs.
Group IV	{	Crushed barley, first 2.2 lbs.; afterwards 4.4 lbs.
	{	Straw meal, 6.6 lbs.

The supplementary forage was properly mixed with basal forage. The experiment proper, which was preceded by a preparatory period, lasted 61 days and took a normal course. During this period it was observed that the pigs of Group IV (receiving straw meal) did not take to their ration willingly. On completion of the experiment, these animals were found to be more poorly constituted.

The following was the daily increase of weight per animal in the different groups:

Group I	(without supplementary forage)	0.86 lb.
Group II	(with sliced potatoes)	1.1 "
Group III	(with cellulose forage)	0.90 "
Group IV	(with straw meal)	0.41 "

The Writer concludes that the productive value of cellulose forage is equal to about 50 % of the value of sliced potatoes, and that straw meal is useless as food for pigs.

- **Value of Lucerne and other Green Forage in Pig Feeding.**—NILS STANSSON in *Konst. Landbruks-Akademiens Sällskap och Tidskrift*, Year XLV, Nos. 1-2 pp. 30-56. Stockholm, 1916.

Researches were conducted at the Central Livestock Breeding Station in Stockholm with the object of ascertaining to what extent green forage can be used in feeding young pigs. The animals experimented on were

subdivided into two groups ; (A) Control group with rations of milk serum skim milk and barley ; (B) Test group in which the serum, milk or barley are in part or in different proportions replaced by lucerne, vetches or green clover. The results may be summed up as follows :

1) Green forage may form part of the daily ration to the extent of 10 % of the total weight without the growth of the animals suffering in any way.

The nutritive value of fresh hay depends on the weather and is generally higher in summer than in winter crops.

2) Lucerne and clover have nearly the same value, so that 2.2 lbs. of barley may be replaced by 15.4 to 16.5 lbs. of lucerne or clover. Vetches owing to the lower percentage of dry substance, are much below the other two pulses ; 19.8 to 22 lbs. of vetches correspond to 2.2 lbs. of barley.

3) Steeping and cooking the forage have no marked influence on the daily growth of the animals, as appears from the following table :

	With fresh forage	With wet forage	With cooked forage
Lucerne	1.040 lbs	1.058 lbs	— lbs
Vetches	0.968	0.805	0.904
"	0.968	1.069	—
Clover	1.273	1.284	1.273
"	1.205	1.157	—
Average of 5 experiments.	0.991	1.065	—
" " 2 "	0.122	1.045	1.089

Finally it was remarked that the dead weight is greater in the pig of the test group partly fed with green forage.

	Percentage of loss of weight in killing.	
	In the test group	In the control group
Lucerne-Serum	26.3	25.2
" Skim milk	26.3	24.2
" Barley	27.7	25.7
Vetches-Serum	23.8	21.8
Clover-Serum	23.2	28.8
" Lucerne	25.5	23.7

781 - Experiments on the Necessity of adding Gravel to Poultry Food. — Bűzäs Gy.

Baromfi-tenyésztők (Poultry Keepers), Year XI, No. 6, pp. 68-70. Budapest, April 1926

In order to ascertain whether there is any advantage in adding small gravel to the food of fattening chickens, as is done by most Hungarian poultry breeders, MR. A. ZATTSCHKE, Chief Royal Chemist, undertook a series of experiments. Their object was, at the same time, to gain further knowledge about the gizzard of graminivorous birds, and ascertain whether the small gravel always found in the gizzard of poultry is an indispensable mechanical factor in digestion.

The tests covered 3 groups of 6 chickens, kept from the 14th September to the 28th November on a diet of maize, partly whole, partly ground. While group I was given carefully screened maize free from all gravel, group

was also given a weighed quantity of gravel, in portions renewed as and when the birds consumed the contents of their trough, so that during the entire experiment each chicken of group I swallowed about 600 grams of gravel. The weight of the gravel varied from 0.14 to 0.24 gr. per grain; the width from 1.2 to 7 mm. and the length from 1 to 10.5 mm. To get rid of soluble parts the gravel was first scorched in a flame, then, before administration, was boiled in dilute hydrochloric acid, and afterwards in water. The average daily ration given per individual was almost equal in both groups: in group I, each subject consumed 73.4 gr. of maize, and in group II, 2.4 g. In the course of the experiments the chickens were often weighed (the results are indicated in 2 tables). In both groups there were birds whose weight increased during the 2 ½ months of experiment, and others whose weight diminished. The latter were the majority, so that at the end of the experiment the weight of the birds of the 1st group showed a reduction of 14 grams (averaging 52.3 per individual), and that of the 6 birds of group II a reduction of 597 gr. (99.5 gr. average per individual).

Allowing for the daily ration of group II, which was 1 gram less, it may be concluded from the above results that the 2 groups assimilated their food in an equal degree, so that from the point of view of grain utilisation it is quite immaterial whether it is administered with or without gravel. In the average change of live weight there was a very small difference between the 2 groups, and it was concluded that the live weight of the birds fed with maize with or without gravel varied uniformly.

At the end of the experiment, the gizzards of the birds of each of the groups were examined, and gravel was found which was carefully cleaned and then weighed. The gizzards of the birds of group I contained on the average 13 grams of such gravel, while in those of group II there was on the average of 6 gr. As however the chickens of group II received no gravel during the test, it is evident that they kept it in the gizzard for about 2 ½ months, which suggests that they use it for grinding the grain swallowed, and that the anatomical construction of the gizzard is such as to render the expulsion of the gravel difficult. (RÉAUMUR had already recognised the necessity for the presence of gravel in the gizzard of granivorous birds).

The 2 757 grains of gravel found in group I weighed together 52.7 gr. (0.019 gr. per grain); in group II, 667 grains weighed together 29.5 gr. (0.044 gr. per grain), which shows that the birds of group II kept bigger grains of gravel. There were also differences in the shape of the gravel; that of group II was rounder and smoother, which must be attributed to the continuous friction in the gizzard. Finally, the grains of gravel weighing 13 grams found in group I prove that the greater part of the gravel was evacuated with the excrement, as the birds of this group had still received 60 grams of gravel on the average, 10 days before being killed.

It follows from these observations that gravel may be dispensed with during the short period of fattening of chickens (intensive fattening lasts 5 days at most), because in the gizzard of poultry there is always the necessary quantity of gravel for grinding the grain. It still remains to be ascertained, however, whether digestion takes place perfectly in case of com-

plete absence of gravel. To clear up this question it would be necessary to prevent newly hatched chicks from swallowing gravel. The fact that the hen brings gravel to the chicks with the very first food containing gravel seems to confirm the opinion that gravel is indispensable for mechanic digestion.

782 - **Cold as the Cause of the Death of Bees in a Colony Wintering under Good Conditions** (1). — ASTOR A., in *L'Apiculture*, Year 60, No. 3-4, pp. 28-31. Par March-April 1916.

In all hives, even those wintering under good conditions, both from the point of view of population and food supply, ventilation, etc., a number of bees always die during winter confinement. This number varies according to the size of the colony, the number of old bees in the autumn, etc., ranging usually from one hundred to one thousand per hive. The writer has found that cold is the cause of the death of the bees. He picks up every morning the bees which had fallen lifeless on the floor of the hive. These apparently dead bees, which if left alone would no doubt die shortly, were put in a queen bee cage made of metal gauze, and gently warmed. The majority of them were restored to life by the warming only, regaining the full vigour and liveliness.

The computation of the bees falling lifeless every day and those restored by warming, and dead bees leads to the following conclusions :

The number of lifeless bees taken from the floor of the hive and the percentage of dead bees relatively to those lifeless in appearance is larger in proportion as the temperature is lower, and vice-versa.

At least 80 % of the bees which perish during the winter in a colony wintering under good conditions are killed by cold.

783 - **A New Skin Disease in Carp in Germany.** — FLEHN M., in *Allgemeine Fischzeitung*, Year 1915, No. 12, pp. 179-180. Munich, 1915.

A description is given of a skin disease, hitherto unknown, which caused great damage in 1915 in fish ponds in Germany. The first symptoms are one or more characteristic dark spots on the skin, which gradually spread and finally reach the size of a 5 shilling piece. The colour sometimes disappears but mostly a hole forms in the middle of the spot; it is shallow, being limited to the subcutaneous layer, which then gives it a fine white colour. The white hole is surrounded by a darker zone which gradually grows fainter. These are the typical symptoms of the disease.

Cases are also observed in which the subcutaneous layer is attacked; it comes away in pieces which float in the water. Below the subcutaneous part attacked, a hole forms in the flesh, the dark colour of the zone loses its intensity, and finally a characteristic abscess forms.

The diseased skin contains enormous quantities of bacteria, and it is beyond doubt that one of these bacteria is the pathogenic agent in the disease. It was however impossible to find the presumed pathogenic agent and the Writer asks all fish breeders and investigators to communicate to him in detail their observations on the disease.

(1) See *B.* 1915, No. 299.

The disease often causes the death of the fish, but only when the latter greatly enfeebled. In some cases recovery may take place.

The dead fish being entirely invaded with bacteria, it was not possible to ascertain where they enter.

The study of the disease is being continued.

FARM ENGINEERING.

1 - **Strecker's Liquid-manure Drill.** - STRECKER, in *Deutsche Landwirtschaftliche Presse*, 43rd Year, No. 33, p. 293; No. 34, p. 304 + Fig. Berlin, April 22 and 26, 1916.

AGRICULTURAL
MACHINERY
AND
IMPLEMENTS

A series of definite principles have been devised in connection with the preparation, storage and use of liquid manure but up to the present there has been no suitable apparatus for *putting it into the soil* in accordance with these principles. It is requisite that the liquid manure should not leave the distributing cask or barrel in a large jet which comes into contact with the soil before reaching the soil; it must be introduced direct into the soil, and protected against air. This condition is complied with by the "Jauchell" (liquid manure drill) of Professor STRECKER, of which the appended figure represents a general view.

After trying all sorts of contrivances, the inventor at last satisfied himself that the best method of preventing access of air consists in the use of steel discs (*g*) similar to those of mechanical seed drills. Small pointed steel shares, with guide roller and adjusting bar gear, precede the discs, cutting into the soil so that the discs can afterwards pass in the furrow and cover up with earth at once. The result is that the furrow flowing in a big jet from the "Schartrichter" (funnelshare) *m* (fig. 2) at once disappears completely in the soil and cannot evaporate in the air. For light soils a share consisting of the funnel *x* and the slide *y* (fig. 3) is sufficient.

The inventor adjusts the apparatus according to the quantity of liquid manure by means of adjustment rings (fig. 4), the aperture of which made to correspond with the opening *7* (fig. 5).

To enable the device to work on a slope, the distributing pipe *3* is suspended pendulum-wise to the chain *12*, and therefore always remains horizontal.

In order to adapt the distributing mechanism to different crops the method is the same as with a seed drill: the lever-stirrups *e* on the lever-riding bar *d* are moved more or less apart according to the space between the rows.

The liquid manure emerging from the barrel through the tap *1* flows through a flexible tube into the distribution pipe *3*, from which it passes down through the socket pipes *11* (figs. 2 and 3) into the funnels *m* closing with tight lids *n*, and afterwards between the steel discs, thus getting to a depth about 6 cm in the soil where it is immediately covered with earth.

This easily handled appliance is made in different sizes for operation hand or by horses.

STRECKER'S Liquid-manure Drill.

500 Lit.

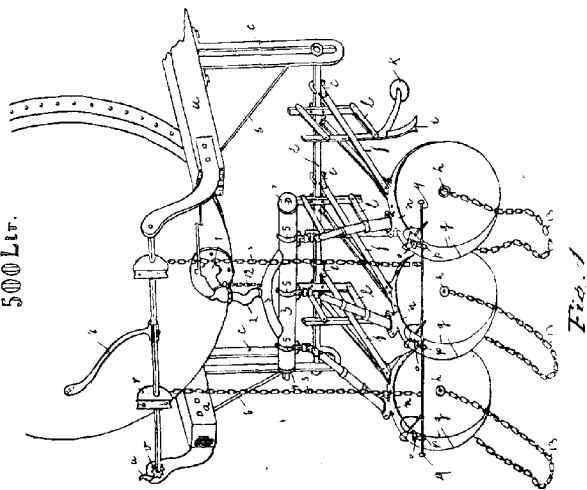


Fig. 1

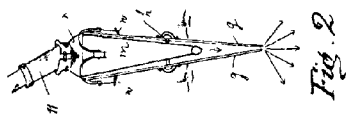


Fig. 2

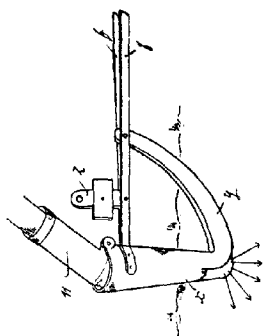


Fig. 3

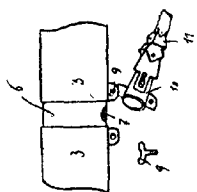


Fig. 5



Fig. 4

5 - **Vasino Winnowing Machine.** — TARCHETTI A. in *Giornale di Riscoltura*, VIIth Year, No. 8, pp. 136-142, fig. Verceili, April 30, 1916.

This simple appliance possesses the following advantages over ordinary winnowers :

- 1) It only runs at a given speed, which prevents excessive increase the quantity fed in, and hasty and bad work.
- 2) The product leaving the machine is put up automatically in a very easy way into bags at the rear end.
- 3) The machine is fully equal to other winnowers in yield, but furnishes a much cleaner product with better separation of the screenings.

Winnowing Machine VASINO.

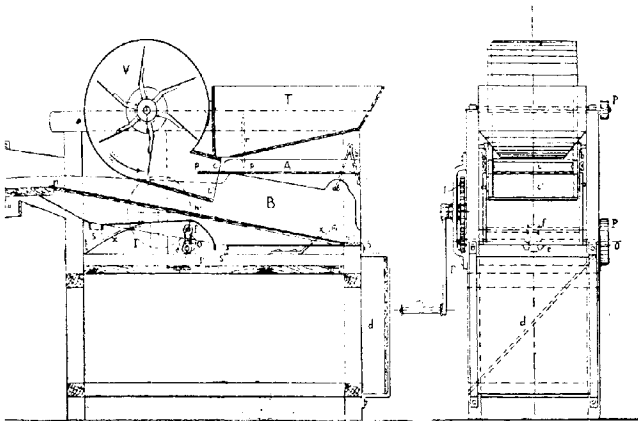


Fig. 1 : Longitudinal Section.

Fig. 2 : Transverse Section.

4) It can be used both for paddy and other cereals without distinction, it being only necessary to change the screens and the direction of the air current.

5) It consumes less driving power : a boy can work it for a long time.

As shown by the 2 figures appended, this machine (which Messrs VASINO afterwards improved in its details) consists essentially of the following parts : a wooden frame, a fan V, a feed hopper T, and two screens, A and B.

The machine is hand-driven by means of the crank *m*, the movement which is transmitted through the gearings I and I', to the shaft *o*, which then transmits it to the screens through the elbow-joint and the connecting rod *c f*; and to the fan through the pulleys P, P' and the belt.

The material contained in the hopper T falls on the 1st screen A, which is a cast iron plate, suspended to the frame by the springs *r* and the 2 arm levers *b*, one being short for the purpose of regulating the screen angle, and

the other long and connected to the edges B of the lower screen, which imparts a rocking movement to it. The screen A is not perforated at its end p p' lying below the discharge aperture of the hopper, so that the material from the latter has to pass over to p' before dropping through to the bottom screen. Through a regulator placed against the vertical wall of the hopper, and by which the fan box may be turned, the fan outlet aperture may be raised or lowered so as to enlarge either the part c which blows *on* to the screen A, or the part c' which blows *below* the same screen. From p' to s the latter is perforated, not by punched holes, but by small arched notches with convex edge bent downwards spoonwise, so as to facilitate the entry of the current of air from below upwards and the descent of the small grain and seeds, while the large grains fall from s into the inclined plane d and the small straw, empty grains, etc., are expelled from the machine by the air current.

During the drop from A to B, the grains are struck by the air current c' and compelled to follow an inclined path which brings them near the end n'' of the lower screen. The latter is supported laterally by the wooden edges B to which is fixed the shaft f receiving the movement of the 4 springs x and x' supporting the screen as a whole. The result is that the latter which under the action of the connecting rod e f tended to perform a perfectly vertical alternating movement, is compelled on the contrary to shift along 2 arcs of a circle with radii which are respectively equal in the lower part to the lever arm x' and in the upper part to the lever arm x . In consequence of the impetus thus given by the screen to the grains covering it, the latter are thrown upwards, and in accordance with the law of uniformly varied movement, they describe a parabolic path, falling on the screen at a point farther up. They thus make small successive intermittent advances, passing up along the screen until they pass through the meshes or fall at s'' , where they are collected.

The screen is generally made of sheet iron perforated on the space n' n'' with small holes for separating the earth and small seeds; on the space n n' with larger holes separating the bad seeds; a sheet-iron apron with a double slope placed below collects the screenings of s'' and s''' , while the stones, which cannot rise owing to their weight, fall from s' into the inclined plane d . In the aperture q through which the cereal descends there is an inclined plane q s'' which, by means of the lever i may be inclined right or left and thus feed the cereal into either of the 2 sacking inlets with which the appliance is fitted, so as to allow of continuous fall of the cereal during the connecting up and taking away of the sacks.

Thus the speed of conveyance of the cereal does not only depend on the lever arm o e of the elbow-joint, but also on the mutual position and the length of the screens x and x' , and still more on the rapidity of alternative movement. The effective conveyance momentum acquired by each grain weighing p must not only be capable of overcoming the frictional resistance against the screen and raising the grain, but also of enabling it to describe such a path that when it falls back into the screen it cannot descend again

owing to the lowering and slope of the screen and the vibration of the apparatus, to the point from which it was raised.

Thus speed plays an essential part in the output of the apparatus and it cannot go below a certain limit, otherwise the apparatus will not work and the grains tend to descend towards the end s' .

786 — **The VASINO Paddy Cleaning Machine, fitted to a Threshing Machine.** — TARCHETTI A. in *Il Giornale di Riscoltura*, VIth Year, No. 9, pp. 151-154, 1 fig. Vercelli, May 15, 1916.

As shown by the appended figure, the paddy cleaning machine designed by Messrs. VASINO BROTHERS (at Ponzana, province of Novara) can be fitted beneath an ordinary machine for threshing this cereal.

The cleaning apparatus is entirely suspended by wooden supports to the lower cross-members of the framework of the thresher. It may receive the reciprocating screening movement either by means of the lever P actuated by an eccentric mounted on the shaft of the 1st beater (the whole shown in dotted lines on the figure), or still better by means of a special countershaft L , fitted with an eccentric or elbow-joint and driven by a belt.

The cleaning apparatus does not gather everything that falls from the gratings of the thresher, but only the material from the 1st shaker and the 2nd beater, because generally the products of the 1st beater do not need cleaning, while those of the last shakers are so full of impurities, and at the same time so small, that it is desirable to blow them separately by hand.

The threshing product falls on an inclined plane (which Messrs VASINO have divided with advantage into several parts: A , A' , A'' , to save space in height), which conveys it to the 1st screen B . The latter may be of perforated sheet iron, but the inventors prefer plates with *oblique* holes (shown in a vertical section on the principal figure, and in plan on the small figure annexed) in order the better to prevent leaves, stalk fragments, glumes, etc. from passing into the lower part.

The nozzle of the fan divides into 2 branches, M and N , at the entrance to which is a slide valve by which the current of air in both may be regulated.

The air emerging from M strikes the grain falling from the sieve B and separates the small straw, empty grains, light seeds and dust, ejecting them from the machine together with the leaves etc. falling from the end of B .

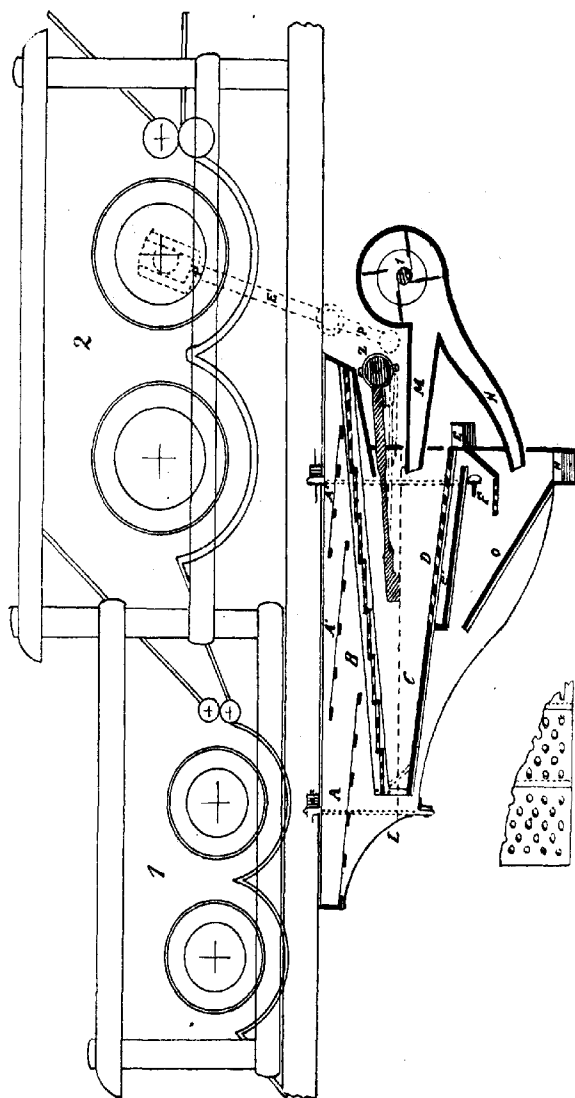
The heavy grains drop on the 2nd screen, which has a solid part C and the rest punched out like the 1st screen, but with smaller holes, with reverse direction of slope at D .

The stones and other large impurities gather in the channel E , from which they are expelled at one side of the machine.

The paddy falls into the plane C' , then on to F , and G , and into the channel H , which discharges it on the other side of the cleaner. In falling from F to G , however, the paddy is subjected to the air current of the channel F , which, striking against G , forms an eddy holding the screens suspended or some moments and freeing them from the last impurities.

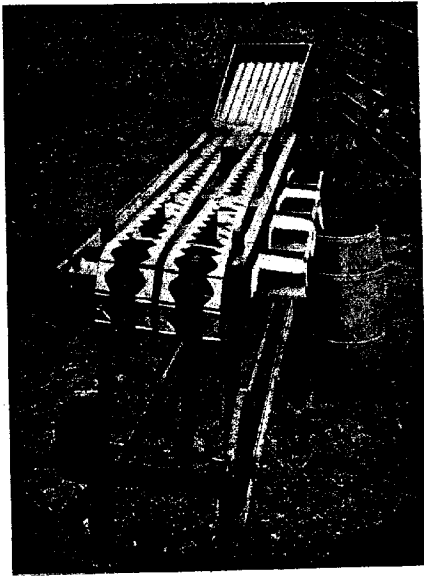
This cleaner, both **simple and efficient**, does not take up much space, requires little driving power and can be fitted to any threshing machine.

VASINO Cleaner fitted beneath Threshing Machine.



Motor-Driven Apple Grading Machine of High Capacity (1).—*The Scientific American*, Vol. CXIV, No. 15, p. 385. New York, April 8, 1916.

The new apple-grading machine shown in the accompanying figure operated by motor power and has a capacity varying from 40 to 60 barrels per hour. The apples can be graded in seven different sizes from $2\frac{1}{4}$ in. up to $4\frac{1}{2}$ in. in diameter, each size varying one quarter of an inch. The principle on which the grader is designed and constructed is very



Mechanical Apple Grader.

simple. It is an endless belt with plates forming hollow squares which change their size as they travel towards the end of the grader. The variation in the size of the squares is accomplished by the spreading of the belts.

A Tractor for the Garden.—*Farm Implement News*, Vol. XXXVII, No. 17, p. 53. Chicago, Ill., April 27, 1916.

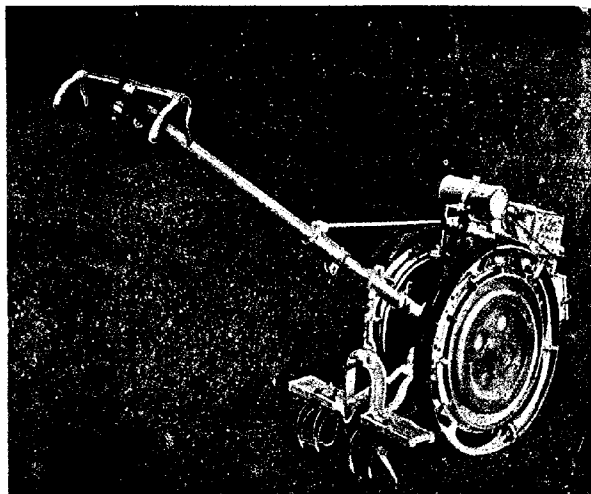
The accompanying illustration shows the garden tractor constructed by the Beeman Garden Tractor Company of Minneapolis, Minn. U. S. It develops nearly three horse-power, the pull on the drawbar being a little

(1) See also *B.*, June 1914, No. 560.

(Ed.).

less than one horse-power. It weighs 450 pounds and has wheels 25 inches high with 3 1/2 inch tires. The height of the handles can be adjusted to suit the operator. It will cultivate anything that grows in rows.

Any kind of garden hoes, cultivator teeth, knives or disks can be quickly attached and a boy or girl can operate the machine for it needs only



The Beeman garden Tractor.

be steered. By going astride the row this tractor cultivates all vegetables grown in narrow rows such as onions, beets, carrots and by going between the rows it will cultivate maize, potatoes, peas etc.

This tractor can also be used for driving other small machines such as pumps, churns, cream separators, wood-saws and the like.

789 - **Experiments on the Fuel used in Farm Portable Engines.** — *Revue de la Direction générale de l'Agriculture, du Commerce et de la Colonisation, Bulletin*, Year No. 87, pp. 49-55. Tunis, March, April 1916.

The present high prices of coals have induced many farmers in Tunisia to use other fuels for their steam engines. The wood of olive trees, lentils and thuyas are those most frequently burned.

The Direction Générale de l'Agriculture has recently caused experiments to be carried out in order to determine the best means of utilizing Tunisian fuels and their value in comparison with that of coal briquettes.

A 24 HP. portable engine driving a straw baling press turning 40 to 50 bales per hour was used for these experiments, in each of which the pressure was first brought up to 64 lbs. by burning only the strict

necessary quantity of fuel, then the press was started, the pressure raised to 64 lbs and kept there while the machines worked steadily for some hours at which the experiment was stopped at the initial pressure of 64 lbs. with the same water level in the boiler. Careful record was kept of the weight of fuel consumed, work done, employed etc., and these data are given in the annexed table.

Fuel	Amount required to raise pressure to 64 lbs.	Consumption whilst working				Material pressed
		per hour	per 100 bales	per 1000 lbs.	ratio to coals	
	lbs	lbs	lbs	lbs		
briquettes	79.2	39.6	99.0	13.2	1 : 1	straw
	79.2	31.5	110.0	13.2	1 : 1	fodder
lignite from Cape Bon. .	81.4	54.8	136.4	18.3	1.39 : 1	straw
from old olive trunks, recently felled	165.0	110.0	275.0	36.8	2.79 : 1	straw
lyptus, branches and stems 10 to 12 inches diameter, felled 10 months previously . . .	162.8	107.8	253.0	33.8	2.56 : 1	straw
oak trunks recently felled .	180.4	115.3	288.2	38.5	2.91 : 1	straw
oak stumps recently felled .	—	90.6	275.0	36.8	2.79 : 1	straw
oak pine, trunks and branches quite green	154.0	110.0	250.8	33.5	2.54 : 1	straw
oak, small branches few centimetres in diam., nearly dry. .	—	84.5	264.0	31.6	2.39 : 1	fodder
oak, stumps felled some time previously.	132.0	116.2	253.0	33.8	2.56 : 1	straw
oak tree, split wood and branches recently felled . . .	132.0	117.7	292.6	35.0	2.65 : 1	fodder
oak, split wood, nearly dry.	125.4	92.0	275.0	33.2	2.52 : 1	fodder

Review of Patents.

Tilling machines and implements.

- a 167 801. Plough.
- 2 452. Improvements in cultivators.
- uk 21 099. Cultivator.
- 21 123 — 21 142. Ditching machines.
- Kingdom 24 471. Subsoiler.
- 408. Power driven ploughs, cultivators etc.
- 802. Motor ploughs.
- States 1 176 047 — 1 176 334 — 1 177 883 — 1 178 515 — 1 179 295. Harrows.
- 1 176 098. Soil pulverizer.
- 1 176 240. Roller attachment for gang ploughs.

- 1 176 514. Weed cutting attachment for disk-harrows.
- 1 176 581 — 1 178 765. Disk ploughs.
- 1 176 626. Combined roller and stalk cutter.
- 1 176 883. Combined weeder and cultivator.
- 1 176 892. — 1 177 649 — 1 178 660 — 1 178 607. Ploughs.
- 1 176 955. Attachment for cotton choppers.
- 1 177 175. Insect trapping attachment for cultivators.
- 1 177 389 — 1 178 025 — 1 180 178. Cultivators.
- 1 177 558 — 1 177 871. Gang ploughs.
- 1 177 974. Weeder.
- 1 178 212 — 1 180 477. Motor ploughs.
- 1 178 767. Ridge levelling harrow.
- 1 179 183. Tractor plough.
- 1 179 241. Plough beam.
- 1 179 315. Plant hill marker.
- 1 179 899. Deep-tilling gang plough.
- 1 180 195. Adjustable draught attachment for ploughs.
- 1 180 456. Coulter brace.
- 1 180 563. Clamps for cultivator standards.
- 1 180 580. Coulter.
- 1 180 815. Disk harrow.

Manure distributors.

- Canada 167 719. Fertilizer distributor.
- United States 1 177 391 — 1 178 137. Manure spreaders.
- 1 180 988. Straw and manure spreader.

Drills and sowing machines.

- Canada 167 950. Sowing machine.
- United-Kingdom 1 481. Machine for sowing seeds one at a time or for planting peas.
- United States 1 176 222. Seed planter.
- 1 176 242. Corn planter.
- 1 176 324. Beet planter.
- 1 176 820 — 1 176 821. Variable drop seed planters.
- 1 176 906. Grain drill attachment for coulters.
- 1 178 263. Potato planter.
- 1 178 311. Seeder attachment for cultivators.
- 1 178 506. Combined planting and fertilizer distributing machine.
- 1 178 571. Grain feeding device.
- 1 178 766 — 1 180 759. Planters.
- 1 179 285. Cotton planter.
- 1 179 579. Covering attachment for seed planters.

Reapers, mowers and other harvesting machines.

- Canada 167 260. Finger attachment for harvesters.
- 167 571. Sheaf loader.
- 167 786. Machine for pulling flax.
- France 479 594. Hand rake for forage crops.
- Switzerland 72 457. Mowers.
- 72 597. Hay harvesting machine.
- United States 1 176 276. Corn harvesting and shocking machine.
- 1 176 361. Binder.
- 1 176 398 — 1 178 013 — 1 179 290 — 1 179 410. Corn harvesters.

- 1 176 547. Grain shocking machine.
- 1 176 585. Machine for making shocks.
- 1 177 104 — 1 178 634. Harvesting machines.
- 1 177 158. Cow-pea cutter.
- 1 177 475. Bean harvester.
- 1 178 419. Grain binder.
- 1 178 521 — 1 179 702. Mowers.
- 1 178 590. Brake for header harvesting machine.
- 1 179 310. Mower attachment.
- 1 179 320. Unloader and stacker for wheat and the like.
- 1 179 676. Hay rake attachment.
- 1 179 997. Self binding harvester.
- 1 180 257. Binder carrying device.
- 1 180 548. Corn stripper.
- 1 180 700. Combined hay stacker and rake.
- 1 180 944. Pea thresher and harvester.
- 1 181 094. Attachment for binders, harvesters and the like.
- 1 181 096. Hay rake and loader.

Machines for lifting root crops.

- Denmark. 21 093. Machine for lifting, topping and heaping root crops.
- United-Kingdom 386. Topping and tailing machine for root crops.
- 975. Potato digger.
- United States 1 176 104. Beet digging machine.
- 1 176 850. Sugar beet topper and puller.
- 1 179 580. Potato digging machine.
- 1 179 767. Beet harvester.
- 1 180 251. Potato digger.

Threshing and winnowing machines.

- Canada 167 193. Grain separator.
- United States 1 176 360. Corn husker.
- 1 176 488 — 1 179 806 — 1 180 443. Threshing machines.
- 1 177 049. Double delivering mechanism for threshing machines.
- 1 177 703. Combined wild oat separator and grain separator and cleaner.
- 1 178 295. Grain separator.
- 1 179 254. Seed separating mechanism.
- 1 179 438. Corn husking machine.
- 1 180 165. Seed grader.

Machines and implements for the preparation and storage of grain, fodder, etc.

- Denmark 21 143. Device in straw presses with sliding ram.
- United-Kingdom 1 161. Apparatus for washing grain.

Dairying machine and implements.

- Canada 167 953. Cream separator.
- Denmark 21 106. Improvement of parts of milking machines.

Other agricultural machines and implements.

- British India 2 223. Improvement in devices for controlling supply of water for irrigation purposes.
- Canada 167 539. Straw rope twister.
- 167 632. Hide removing instrument.

Cuba	2 453. Improvement in sugar mills. 2 458. Improvement in machines for stripping sugarcane leaves. 2 466. Filter-press.
Denmark	21 127. Plant thinning machine. 21 128. Device for the cooling of preserve glasses and jars. 21 155. Link for iron tether.
France	179 538. Sprayer utilizing bicycle pumps as source of pressure.
United-Kingdom	193. Foster mother for chickens. 787. Machine for preparing fibres for spinning. 789. Tea rolling machine. 1 255. Machine for thinning root crops. 1 323. Insect traps.
United States	1 176 182 — 1 178 552 — 1 178 993 — 1 180 962. Traction engines. 1 177 497. Calf weaner. 1 177 783 — 1 178 761 — 1 178 838 — 1 179 066 — 1 179 900 — 1 180 470 Tractors. 1 178 782. Corn topper.

791 — **Inverted Siphons Replace Bridges where Canals Cross Roads.**— *The Engineering Record*, Vol. 73, No. 15, p. 478. New York, April 8, 1916.

The extensive system of main irrigation canals and laterals in the Imperial Valley California has presented in many places the problem of getting the highways across the canals without interfering with the function of either. Bridges were built across the larger canals but as the channels are above ground level, heavy gradients were required for the approaches.

It was formerly believed that inverted siphons would not be feasible on account of the quantities of silt carried by the irrigation water and which it was feared would fill up an under-ground conduit. Experiment, however, has proved that velocities of 2ft. per second would keep the corrugated pipe siphons clear of silt although 3ft. per second is desirable for carrying the heavier sands. As a result a great many siphons have been installed and this has led to a much more satisfactory road system.

A number of these siphons are of corrugated iron pipe with collars and head walls of concrete; others, where concrete material is lacking have timber head walls. It has been found that Oregon pine inlet and outlet walls last about eight years in the dry soil and this is considered as suitable as more permanent work.

The inverted siphon method obviates all difficulties where it is necessary to carry two canals across a road and across each other. This is now done by means of two siphons, one beneath the other.

792 — **Small Irrigation Canals Lined with Concrete to Prevent Seepage Water Loss.**— EDWARDS, C. E. in *Engineering Record*, Vol. 73, Nos. 16 and 17, pp. 508-510 and 539-541. New York, April 15 and 22, 1916.

As a result of lining with concrete about 40 per cent of the canals and laterals of the Okanogan irrigation project in Washington, seepage losses have been reduced from 51 to about 15 per cent of the total water received at the head works. The lining has been placed in the sections of

canals where seepage losses were greatest, these localities having first determined by current meter measurements.

The losses in the canal system for 1911 with 43 miles of canals and laterals in operation and only 1 mile concrete lined was 51.1 per cent, an average of 1.2 per cent per mile. The loss for 1915 was 20.4 per cent with 76 miles of canals and laterals in operation, or an average of 0.27 per cent per mile. It is estimated that the further lining for $5\frac{1}{2}$ miles which will be completed before this year's (1916) irrigation season commences will reduce losses to less than 15 per cent.

In the original designs most of the canals were built with 1 on 1 $\frac{1}{2}$ slopes on the upper portions of the project and 1 on 2 side slopes on the lower or sandier portions. A friction factor of $n = 0.025$ was used for the lined canals, while $n = 0.015$ was found to be safe for concrete lining. The canals as already built and in operation were generally too large for lining without back filling. A concrete lining 1 $\frac{1}{2}$ inch thick was decided upon with a backfill of sand and gravel of at least 3 inches on the bottom and side slopes. According to the size of the canal in some places, backfill required was 4 to 8 inches and sometimes as much as 2 feet.

The writer describes in detail the methods followed in carrying out the work. Altogether, 134,000 lineal feet of canal were lined and they required 7500 cu. yards of concrete.

The following table gives some data concerning the work done and cost per cubic yard and per lineal foot.

	Section A	Section B	Section C	Section D	Section E
Height of bottom, feet	0.50	1.25	2.00	3.00	4.50
Depth " "	1.10	2.00	2.25	3.20	4.60
Center " "	5.45	7.03	11.10	15.52	22.06
Cu. yds. concrete per 100 ft. of lineal	2.52	3.65	5.15	7.15	10.20
Cu. yds. backfill per 100 ft. of lineal	5.00	7.5	12.00	38.00	28.00
Vol. per cu. yd. of concrete	39.50	27.40	19.40	14.00	9.82
Cost per cu. yd. concrete foundation \$	9.815	9.700	9.695	9.877	8.065
Cost per lin. ft. \$	0.248	0.355	0.498	0.706	0.823

Part of the lining has been in use for four seasons and has given good service and shows no signs of wear. No trouble has been experienced on account of expansion or contraction injuring the lining even when the lining is dry during half the time in summer.

RURAL ECONOMICS.

793 - **Increase of Yield of the Soil in the Alpine Regions of Salzburg, Austria.** — R. ERNST, in *Wiener Landwirtschaftliche Zeitschrift*, No. 52, pp. 407-409, Vienna, June 30, 1911.

In spite of the long-continued efforts of leading men to replace the old-date system known as "Egartenwirtschaft" (1) by a rational cultivation of the Alpine region, no noteworthy progress has hitherto been recorded in that direction. The "Landeskulturrat" of the Tyrol alone has to this very important question in hand.

The enormous value of intensive forage crop production is obvious if we consider that in Austria about 311 220 acres are cultivated on "Egart" system, the yield of which might without any great difficulty be doubled, and if we compare the yield of artificial grasslands, which give 80 to 100 or even 240 cwt of hay per acre, with that of the "Egart", which gives only 16 to 64 cwt. We may remark that in this comparison no allowance has been made for the fact that artificial grass-land produces a quality of forage considerably superior to that of the "Egart", which contains from 1 to 80 % of weeds or poor quality grass. Unless the population are continually instructed and the question is handled and constantly kept under review by competent authorities, and the necessary information supplied when required, that is to say, unless somebody thoroughly at home in this question both theoretically and practically, takes it up systematically, money granted to the "Subventionswiesen" (subsidised grass-lands) in most cases will be absolutely wasted.

Not only those parts of the country where "Egart" is practised very much behindhand, but also those where cultivation prevails, are at present still fallow lands, for instance the "Flachgau" of Salzburg in Upper Austria and in various parts of Lower Austria, where tillage rotation is still carried on. As the small region of Salzburg presents two very distinct systems of cultivation, it is expedient to mention the conditions of soil utilisation existing on present farms.

I. — Region known as the "Egart" Region (Pinzgau, Pongau, L. and Tännengau). — The most usual rotation is: grain crops, grain and grass, then 4 years "Egart"; or grain 3 times running, and 3 years "Egart". There is no reason to do away with this system; it is sufficient to substitute artificial grass-land for natural grassland. On his trial lands, which were tilled and dressed after the usual manner of the country, the farmer nevertheless obtained yields equal or very close to those generally obtained. It is evident moreover that the yields undergo considerable increase if more careful tillage is done and if the preceding crop is better chosen.

(1) The "Egartenwirtschaft", or "Egart" system, as practised in the mountainous parts of Austria, part of Bavaria, etc., consists in fallowing for a certain period, laying down for the same period, and cereal growing for a further equal period.

There may be taken as an example the results obtained at the School of Agriculture of Oberhalm, Tannengau, and summed up in Table I.

TABLE I. — *Results obtained at the School of Agriculture of Oberhalm.*

A. — *Cost of bringing an acre of land under cultivation (excess expenses as compared with "Egart" system) — Cover crop: oats.*

	£	s.	d.
1 days ploughing (cost of team 6s. 8d. per day)	6.	8	
$\frac{1}{4}$ day harrowing (at 6s. 8d. per day)	1.	8	
$\frac{1}{8}$ day to cover seeds mixture		10	
$\frac{1}{2}$ day to sow oats and seeds mixture	1.	0	
$5\frac{1}{2}$ bushels of oats at 2s. 6d. per bushel	14.	9	
	1.	4.	11
Mixture of clover and grasses	1.	3.	4
	2.	8.	3

B. — *Yield of hay per acre in cwt. (valued at 2s. 6d. per cwt.).*

	1913				1914			
	cwt.	£	s.	d. per cent	cwt.	£	s.	d. per cent
Rotation grass land	85.61	10.	14.	0	140.66	88.	70.	11. 2. 0 153
"Egart" control	59.73	7.	9.	0	100.00	57.	84.	7. 4. 6 100
Increased yield	25.88	3.	5.	0	40.66	30.	86.	3. 17. 6 53
Cost of bringing under cultivation		2.	8.	3				
Net profit			16.	9				

C. — *Composition of:*

Rotation grass land:	Green oats clover and improved grasses.	18 % weeds and bad quality grass.
"Egart" control:	Clover and improved grasses.	43 % weeds and bad grass in the hay. 51 % in the aftermath.

In the regions where "Egart" is practised, and where grass grows heavily, the trials showed that starting cultivation with still green cereals is by far the most advantageous. The reasons are several:

- 1) This power of strong growth of the grass also influences the cereals, which develop powerfully and produce a large quantity of culm and leaves, throwing so much shade on the seed that its growth is very much impeded;
- 2) These cereals lodge easily, which makes the result of sowing doubtful;
- 3) It is impossible by tillage to secure anything like complete elimination of the weeds owing to the shallowness of the arable soil.

Besides this, when the fields are sown with ripening cereals, one half at least of such seed is lost. Starting cultivation with still green cereals means

some increase of labour, which is more than made up for by the very much superior quality of the forage. The estimate of starting expenses given above shows that the increased labour only amounts to 2 days' labour of one person per acre and just over $1\frac{1}{4}$ days of one team, and it only recurs every 6 years; evidently then this increased labour can hardly cause any difficulty.

II. — So-called Ploughing Region (Flachgau). — As an example clearly showing the increase of yield which may reasonably be expected, the results obtained on the farm of the peasant *Stadler* at Vollern near Oberndorf and summed up in Table II, may be adduced.

TABLE II. — *Results obtained on the Farm of the Peasant STADLER at Vollern near Oberndorf*

A. — *Costs per acre of putting under cultivation*
(*excess of expenses over permanent natural grass land*) — *Cover crop: oats.*

	£	s.	d.
As previously	1.	4.	11
Plus mixture of clover and grasses	1.	5.	
Total expenses	2.	9.	11

B. — *Yield of hay per acre (valued at 2 s. 6 d. per cwt).*

	1913			1914		
	cwt.	£	s. d.	cwt.	£	s. d.
Artificial permanent grass land	47	5.	17. 6	71	8.	17. 6
Natural permanent grass land	27	3.	7. 6	42	5.	5.
Increased yield	20	2.	10. 0	29	3.	12. 6

C. — *Starting cultivation with ripening oats.*

The expenses also amount to £2. 9. 11.

D. — *Yield per acre in cwt.*

1913				1914			
	cwt.	£	s. d.		cwt.	£	s. d.
Starting cultivation	Grain 12 (at 7 s. 7 d.)	=	4. 11. 0	Hay.	87	10.	17. 6
	Straw 21 (at 2 s. 7 d.)	=	2. 3. 9				
Total			6. 14. 9				
Expenses to be deducted			2. 9. 11				
Net profit			4. 4. 10 (1)				
Control plot, hay	31.25 (2 s. 6 d. per cwt)	=	3. 18. 0		57	7.	2. 6
				Net profit	30	3. 15. 0	

(1) Evidently therefore the seed and labour are paid for and the profit realised is enough to cover the loss of one hay crop.

In this particular case (and also perhaps all through the "Flachgau" where fallow land is maintained), the starting of cultivation with ripening cereals is preferable to cultivation with still green cereals; on the other hand the quality of the forage is not quite so fine.

The most frequent rotation in the regions known as arable regions is: rye, oats (with clover sowing), clover, wheat, oats, fallow. "Egart" cultivations are however also met with, and also the different variants of the above example. Fallowing is an inherited trouble.

One must not reckon too much on the resulting increase of the productive power of the soil as it does not exceed that of a well manured field under some well cultivated crop or pulses. From this point of view, fallowing may still be adopted in special cases and by way of exception, but not as a cultural system. On several peasant farms the Author made a trial and replaced fallowing by a corresponding period of some cultivated crop and vetches and oats sown together; the rye which followed was better in quality than that growing after fallow. For instance, on the farm of the peasant ENZENBERGER, at Enzesberg near Thalgau, the trial of oats and vetches produced a crop of forage amounting to 140 cwt per acre, which is equivalent to $140 : 4 = 35$ cwt of hay. In other places the yield was still higher: the farm of "Windhof", for instance, obtained $208\frac{1}{2}$ cwt of forage. Reckoned per labourer, fallowing required 5.5 days labour per acre, oats and vetches only 4.5.

According to the *Statistical Year-Book of the Imperial and Royal Ministry of Agriculture*, there are in the Salzburg region 70 994 acres producing only 23.5 cwt of hay per acre. Assuming, without any allowance for local efficiencies (defective ploughing, etc.), that by undertaking work on a large scale and reckoning only 30 % increase, a much higher result will be secured, there would then be obtained 7.07 cwt of hay per acre (30 % of 3.5 cwt) or, for the 70 994 acres 412 182 cwt of hay, or again (1 cwt being worth 2s. 6d.) £63 780. Deducting one-fourth, or £15 945 at the beginning of the year, to cover the expenses of starting, there remain £47 835. Furthermore, according to the report of the Imperial Royal Society of Agriculture at Salzburg, the total grass-land area in "Flachgau" is 45 515 acres; assuming that 50 % is made up of sour grass-land, there still remains 22 757 acres permanent grass-land the yield of which may very well be increased 60 or 70 %, as was shown by the example of the farm of Vollern. Reckoning a production of 24 cwt per acre, the assumed increase of 30 % in the yield would represent 7.17 cwt per acre, making for 22 756 acres, 62 160 cwt of hay, worth (at 2s. 6d. per cwt) £20 345. Still according to the report of the same Society, there remain fallow in the "Flachgau" 286 acres. Taking as a basis the example of the Enzesberg farm, one would obtain $35 \text{ cwt} \times 4386 = 153\,510$ cwt of oats and vetch hay worth at 2s. 6d. per cwt) £19 138. For the entire Salzburg region, this would mean an annual return of 815 563 cwt of hay, and, in round figures, a net profit in hay value of £83 750, and consequently a great increase in the public wealth of Salzburg.

AGRICULTURAL INDUSTRIES.

794 - **Table Wines and Blending Wines of Sicily.** — MANCINI CAMILLO, in *Giornale vini-colo.* 42nd Year, No. 21, pp. 369-371. Casale Monferrato, May 21, 1916.

PROVINCE OF CATANIA. — This is the province in which wine-growing covers the largest area: 111 940 acres, producing on the average 6875 000 bushels of wine, or more than half of the entire production of the island. In view of the special conditions created by Etna, where the vine extends up to more than 3 000 feet, the province of Catania produces very varied wines, from highly alcoholic to the lightest, chiefly red wines, though there are also excellent white wines.

Red Wines of Etna: 1) *Wines of the plain of Mascalì* (Giarre, Riposto and Acireale), blending wines, with distinct aroma, alcoholic and strongly coloured;

2) *Wines of the plain of Calatabiano* (Piedimonte Etneo, Fiumefreddo, Faggi, etc.), less alcoholic, aromatic, fairly agreeable, reserved chiefly for local consumption;

3) *Wines of Feudo*, produced in the Feudo plain; less coloured and less alcoholic, do not keep so well;

4) *Wines of the middle mountain zone*, grown on the slopes of Etna (Randazzo, Linguaglossa, Castiglione), of ruby colour shading to orange; good taste; agreeable aroma, medium alcohol content;

5) *High mountain wines*, grown on Etna at between 2 600 and 3 900 f altitude; these are light and tart table wines.

White Wines: The southern slope of Etna (Viagrande Zafferana, Trecastragni, Pedasi, Nicolosi) produces good white wines. If allowed to mature by ageing, they constitute excellent table wines. The province of Catania also produces white wines of the Marsala type.

In 915 wines of this province analysed at the Royal Wine-making School of Catania, the alcohol content ranged from a minimum of 60 (Giarre) to a maximum of 14.5 (Acireale).

PROVINCE OF PALERMO. — Possesses 55 600 acres of vines producing a little more than 22 million gallons of wine of every description, from the commonest to the finest table and blending, white, red and light red. The blending wines with a fine garnet-red colour are produced by "perricone" stock; when blended with the white "catarratto", the "perricone" gives fine red table wines. These stocks, with the system of "pesta-imbotta" (1), give excellent light red wines. Some white wines of the Sauterne type, but warmer and more alcoholic, are also known abroad: the *Corvo* of the Duke of Salaparuta, the *Calatubo* and the *Zucco*. In

(1) According to the system known in Sicily as "pesta imbotta", the must, produced by treading the grape with the feet shod with nailed boots in masonry vats, is collected in "mastelli" (lower vats), from which it is conveyed to casks (which are filled $\frac{1}{3}$) to complete alcoholic fermentation. — Cf. Dr. Antonio Sannino, *Trattato completo di Enologia*, Vol. II, p. 39. Conegliano, 1907. (Ed.)

wines of the province of Palermo, analysed at the above mentioned hotel, the alcohol content ranged from a minimum of 119.6 (Santa Flavia) to a maximum of 180.14 (Partinico).

PROVINCE OF MESSINA. — Although the vineyards here only occupy the coastal region, they nevertheless cover 51 400 acres and produce on the average more than 17 600 000 gallons. The most famous wine of the province is *Milazzo*, produced by the "Nocera" stock; this is a much appreciated blending wine because it combines fairly strong acidity (6° to 10°) with colour and rich alcohol content (14° to 16°). The wines of Faro are in high repute in the province. The Aeolian islands produce the famous *Wine of Lipari*, one of the finest white wines, containing from 13° to 15° alcohol and from 17.28 to 27.20 ounces of dry extract per gallon.

PROVINCES OF GIRGENTI AND CALTANISSETTA. — The wine making industry is of no particular importance here.

More than half the Sicilian vineyards have been restocked with American wines.

The Wine of Grapes treated with Arsenates. — TROFIMENKO M. and OBIEDOFF S. in *Le Progrès agricole et viticole*, Year 33, No. 14, pp. 331-333. Montpellier, April 2, 1916.

By experiments recently carried out at the School of Agriculture of Montpellier (France), the writers show that in the control of the parasites of the vine, particularly *Conchylis ambiguella* and *Polychrosis botrana* of second generation, arsenical salts embodied in wet mixtures are superior to the other treatments tried. To allow of general application of these, however, there must be the certainty that the wine produced will not be poisonous.

Messrs. MOREAU and VINTE have already shown, by experiments carried out in the north-west of France, that these wines are not toxic. Nevertheless, as it may occur that in these parts the frequent rains wash all the arsenic applied off the grapes, it was desired to repeat the experiments at Montpellier under the most favourable conditions for the continuance of arsenical salts, both on the grapes and in the must.

The grapes had been treated late with wet arsenical mixtures; no rain occurred between the treatment and vintage; the arsenical substance had formed a continuous layer round the grapes, stalks, and stems.

The density and acidity of the must obtained from the grape subjected to different treatments (nicotine, arsenic, lime, water 65 %) and from the control grapes were practically the same. Wines obtained from grape treated with arsenic showed under analysis the following quantities of arsenious hydride:

Red Wine	Arsenic	White Wine	Arsenic
(1st)	Traces (0.0002 per litre).	Wine	Nil
(2nd)	0.001 gr per litre	Lees	Traces
mls	0.05 gr per kg of dried grounds.		

Although all the operations were conducted so as to ensure the best conditions for the arsenic to pass into the wine as much as possible (the floating skins were forced under regularly every morning; the must was stirred; racking was delayed until the completion of fermentation); arsenic is therefore absolutely absent from white wine and only occurs in minute traces in red wine. The latter tasted very good; the Authors consumed from 5 to 6 litres of it without the slightest sign of poisoning or indisposition occurring.

The lees may be used for extracting the tartar, washing being sufficient to remove the arsenates. The grounds cannot be used either for cattle or poultry food.

Other uses of the grounds are possible (manure, treatment of dew, etc.)

The experiments will be continued.

796 - **The Determination of the Iodine Index of Alcoholic Liquids.** — MARCILLE R. *Bulletin de la Direction Générale de l'Agriculture, du commerce et de la colonisation*, 2^e Year, No. 86, pp. 18-28, Tunis, January, February 1916.

It is proposed to study the action of light during the determination of the iodine index in essential oils, this action being remarkable when the oil is dissolved in alcohol. This is a matter of practical importance, especially now that, apart from current requirements of the liquor trade, other reasons for these determinations have been created in consequence of the legislation as to the maximum content of essential oil in alcoholic liquors.

The Author sums up in a few tables the results of the determination of the iodine indices, in the dark room, with reduced light and in full day light for some essential oils, as well as the influence of the alcohol content, the length of contact, that of the temperature, the grade of the essential oil, its quality and age. The following are the final conclusions:

Among the essential oils studied, those of Aniseed and *Illicium anisatum* (Chinese Aniseed) alone show an increase in the iodine index through the action of light, and this property may be used to characterise them. Any mixture of essential oils which exhibits in light an iodine index above that obtained in the dark room, will contain oil of aniseed or oil of *Illicium anisatum*. Oil of peppermint is distinguished from menthol by the fact that the former has a remarkable iodine index, while that of the latter is not. Thus even the ratio of mixture in flavoured products might be determined. The determination of the iodine index of essential oils requires the following precautions: the use of a uniform volume of alcoholic solution of the same strength in all the tests (100 cc. of solution at 50°), the addition of the chloro-iodo-mercuric solution (30 cc.) in a dark room and keeping the bottle in the dark during contact; taking care that all solutions should be of the temperature of the surrounding air. For accurate determinations, the tests with a standard essential oil preparation should always be carried out at the same time.

***Pectinobacter amylophilum*, a New Organism which may be of Practical Importance in Flax Retting.** — MACRINOV J. A. (Sur un nouveau microorganisme provoquant la fermentation de l'amidon et des substances pectiques), in *Archives des Sciences biologiques*, published by the Imperial Institute of Experimental Medicine in Petrograd (French edition), Vol. XVIII, No. 5, pp. 440-452, 8 fig. Petrograd, 1915.

When carrying out bacteriological analysis of a sample of soil, a new micro-organism was isolated the behaviour of which in the presence of starch attracted attention. In contrast to other micro-organisms which have the power of decomposing starch but prefer sugar, this one prefers starch to sugar.

The researches were conducted at the Laboratory of the Section of General Microbiology in the Imperial Institute of Experimental Medicine in Petrograd. Here the behaviour of the new bacterium was studied in relation to the fermentation of sugar, starch and many other carbohydrates, pectic substances, nitrogenous substances, and cellulose, and also the products of its vital activity in a suitable environment.

The name of *Pectinobacter amylophilum* corresponds to the biochemical properties of the new bacterium. The name of the genus, *Pectinobacter*, indicates its property of acting on the pectic substances; and as to the name of the species, *amylophilum*, it points to its tendency to use starch exclusively as carbohydrate food.

Pectinobacter amylophilum is rod-like, somewhat swollen towards the centre, from 4 to 6 μ in length, with a diameter of 0.5 to 1 μ . It is mobile, and fresh cultures have a spiral movement. Before sporulation, the bacterium assumes a spindle-shaped appearance, and the spores, elliptic in shape, are borne in the widest part of the rod. When the vegetative parts of the bacterial cell are destroyed, the spores are set at liberty, and, if the medium is favourable, their development begins.

CONCLUSIONS: 1) *Pectinobacter amylophilum* is the specific agent of the fermentation of starch and pectic substances. It also acts on the products of hydrolysis of starch, although it has an evident preference for the latter.

2) Owing to its property of acting energetically on the pectic substances in an aerobic environment, the new microbe may be of great practical importance in flax retting.

The behaviour of this microbe in relation to pectic substances has been studied in the process of flax retting, in aerobic, anaerobic, and mixed environments. In the first case, the flax stalks, bound into bundles, were retted in pure water. In this way a large quantity of organic substance was extracted. The liquid was thrown away and the bundles sterilised in new water. After inoculating with bacteria, the bundles were placed in a thermostat at a temperature between 30 and 45° C. After 8 to 10 days, retting was complete. The fibres as well as the boon separated easily. It was found from experiments with the fibre that it is of good quality and considerable strength, although fine and delicate. It keeps whole and does not break up into shreds. The yield of the flax in the shape of fibre and tow is an excellent one with this treatment. Investigations are being continued.

The retting in an anaerobic medium was carried out in wide tall glass

cylinders filled with water to the brim, the whole length of the flax bundles being put into the cylinders. Sometimes, in order to have a real anaerobic environment, small bundles of flax stalks were put into small test tubes, and the air pumped out. The experiments showed that the action of the microbe in an anaerobic environment is insignificant. In a mixed environment (intermediate between aerobic and anaerobic) the work of the bacterium is less active than under purely aerobic conditions, and more intense than under anaerobic conditions.

(3) The new bacterium, which has the power of acting on starch and destroying the vegetable tissues, should play an important part in the destruction of the vegetable masses falling on the soil.

798 - **New Method of Flax Retting Invented at the Technological Institute of Petrograd**
— See No. 753 of this Bulletin.

799 - **Hats made of Chinese Palm Leaf.** — CHIERI C., in *P.A. Agricoltura Coloniale*, Year 1st Half-Year, No. 4, pp. 187-189, Florence, April 30, 1910.

A new Chinese industry is here described, namely, the manufacture of hats from the leaves of a palm tree not yet identified botanically and which the Chinese name merely describes as Tung-shu (palm plant).

This palm tree is said to be one of the varieties of *Chamaecropis fortunei*.

The leaves for hat manufacture are gathered at Kwank sien, a few miles from Chêngtu, a hilly part of the country, where the plant grows wild in large numbers, thriving in the rather poor and moist soil. The tree presents different varieties, some specimens reaching a height of 10 feet. For hat-making, however, the leaves of the small, young plants are used as they are more fibrous and flexible, and narrower. The leaves are imported into Chêngtu and are there cut up into long strips of uniform width. From each leaf 100, 110 or up to 120 strips are cut, according to the quality of the hat and the flexibility of the leaf. The cut strips are boiled in water and steeped in a special bath, from which they emerge high yellow in colour. On drying by exposure to the air the colour turns to pearl. For a hat of the finest quality, 16 leaves, i. e. about 1750 strips are required, while an ordinary hat requires an average of 1100. The hat is begun and finished by the same workman, and is afterwards washed in an acid solution of secret composition and is next hammered, if desired. Hammering, which is carried out by specialised workmen with polished round stones, is a difficult operation which imparts to the hat a particular brilliant gloss of very pleasing effect.

The best hats turned out by this new Chinese industry, which is barely a year old, are fully equal to genuine panamas. They are in such demand on the home market that it is intended to double the number of workmen. Enquiries from abroad are also beginning to come in.

800 - **The Cheese Industry in Portugal.** — RAMIRES BAPTISTA ADOLPHO, in *Boletim de Vulgarização Científica*, Vol. XIV, Part III, pp. 156-164, Braga, May 1916.

The cheeses manufactured in Portugal proper are of different types named according to the locality or region of production. They are generally

y small, being from 1.1 to 4.4 lbs. each, or in rare cases 4.4 to 6.6 lbs.

Among the oldest kinds manufactured, the chief are: 1) "Serra da Atrela" and its varieties "do Alemtejo" and "de Azeitá"; 2) "Castello Branco"; 3) "do Rabaçal". All of them are made from ewes' milk except "Castello Branco", which is made from goats' milk or goats' and ewes' milk mixed, and they are all soft cheeses. The best is the Serra, which, if well prepared, will compare with any foreign cheese made from ewes' milk. Besides these, however, there are a large number of very different descriptions of cheese of local manufacture and consumption, among which there are mentioned: "saloio" made with cows' milk in the neighbourhood of Lisbon, and eaten fresh; the hard goats' milk cheese of Beira-issa; and the small cheeses of Serpa weighing from 2.4 to 3.5 ounces and very delicate flavour. During the last few years two new descriptions worth mentioning have appeared on the market, the only hard cheeses manufactured in Portugal: one is an imitation of "Caerphilly", and the other is known under the name of "Cardiga". Imitations (generally sold) of Camembert, Edam and Gouda are also made.

In the Azores, where cheese-making is on an industrial scale, the hard cheeses "Pico", "San Jorge" and "Terceira" (so-called from the name of the islands where chiefly produced) have been manufactured for a long time almost exclusively from cows' milk. From the island of San Miguel the cheese industry has long since disappeared, butter-making having completely taken its place. The cheeses produced in the Azores are held in great esteem in Portugal. They weigh from 11 to 33 lbs. each, and sometimes, though less frequently, 44 to 66 lbs.

In Madeira, cheese-making is in process of development. Fairly successful imitations of the Edam, Gouda and Cheddar cheeses are turned out, and milk, produced in large quantities by the butter industry, being partly utilised.

Among the cheeses made in Portugal proper, the Serra fetches the highest price (from 45 to 60 centavos, i. e. 11d. to 1s. 3d. per lb.) The Alemtejo is hardly any cheaper, but the island cheeses are a little lower in price; the minimum market value to which they sometimes drop is 30 centavos, or 7½d. per lb.

In Portugal, the total annual production of cheese has been calculated as amount to 6210 tons, being 5500 tons for Portugal proper and 650 tons for the Azores. These figures do not include Madeira. The quantity manufactured from ewes' milk is estimated at 3000 tons, that from mixed ewes' and goats' milk at 1100 tons, that made from goats' milk at 1200 tons and that from cows' milk at 910 tons.

In continental Portugal cheese-making is chiefly a home industry, carried on with primitive implements and on primitive methods. For curdling, the rennet of the kid is sometimes used, but mostly the dried flowers *Chama Cardunculus*. There are, however, some large factories equipped with up-to-date plant; these turn out almost all the cheese manufactured on the islands.

The manufacture of imitations of foreign cheeses, chiefly as an ad-

junct to the butter industry, was encouraged a few years ago by the district agricultural experiment Farms ("Quintas districtales") and afterward by the Schools of agriculture, especially those of Santarem and Coimbra.

The chief defect in the cheeses produced in Portugal proper is their lack of standard quality. As to the quantity produced, it is only limited by the milk available, there being a sure market for the entire output. The excessive number of very small farms with little livestock makes it difficult to improve the cheese industry. In the Serra da Estrella, where sheep and goats are most productive, each female, during the lactation period, furnishes 8.8 to 9.8 galls. of milk beyond what is required for rearing, which is a comparatively good output. The flocks, however, are very small, rarely numbering more than 200 head. Mostly they consist of 100 and even less. Here and in Central Beira, the milk production is of equal importance with wool production. In the Alemtejo, milk production is secondary in importance to wool, meat and tallow. Though in this latter province the flocks are larger, this is set off by the low figure of production, which sometimes is only 2.2 galls per head above the rearing requirements.

801 - **The Measures to be adopted for Preventing Unfair Competition in the Cheese Trade.** — BÄRTSCH J. and HALDEMANN M. (President and Secretary of the Swiss Union of Cheese Exporters). *Fédération Internationale de Laiterie, V^{ème} Congrès International de Laiterie à Berne, 8 au 10 Juin 1914*, IVth Section, 8th Question, Report No. 3, pp. 12.

The writers put forward the following proposals, the carrying out of which may assist in combating unfair competition.

1. Constant work subsidised by the State, with the object of improving the quality of milk and dairy products (keeping powers, fat content, etc), *i. e.* :

(a) Directions as to fattening, treatment and feeding of dairy cows (return to nature) ;

(b) Instructions as to milking (the utmost cleanliness in milking and handling the milk) ;

(c) Strict observance of existing laws (law on the trade in food products, special enactments and regulations) ;

(d) better technical training for manufacturers (cheese makers), as, if the goods will not keep, they have to be sold at any price, and the fluctuations are in that case ruinous.

The importance of milk and dairy products in human food alone justifies these measures, apart from the enormous value involved.

2. Establishment of international standards for a uniform method of judgment and analysis of cheese, which would allow for present commercial practices and training of specialist experts whose opinion would be decisive in disputes.

3. More intensive joint work between co-operative organisation, Chambers of Commerce and the authorities.

4. Thorough systematic propaganda for the increased consumption of cheese as a healthy food for the people.

802 - **Changes occurring in Potatoes during Storage.** — See No. 743 of this Bulletin.

PLANT DISEASES

DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

913 — **Gummosis in the Citrus Plantations of Florida.** — STEVENS H. E. in *University of Florida, Agricultural Experiment Station, Report for the Fiscal Year ending, June 30th, 1914*, pp. 57-71. Tallahassee, Fla., 1915.

Gummosis is common in the citrus plantations of Florida, causing great damage year by year, especially in the north. Among citrus trees, *C. Aurantium amara* alone appears exempt.

Very little is known as to the origin and cause of this disease. It is certain that its development is influenced by several factors, and although many species of fungi are associated with gummosis, none of them can be regarded as the true pathogenic agent.

With the object of making a contribution to the study of this interesting question, the writer undertook a series of researches and experiments and a very careful investigation into the course of development of the infested areas. Several inoculation trials were made, both with crude diseased material and with pure cultures of *Diplodia natalensis* and *Phomopsis Citri*.

The 18 infested areas studied for a period of 13 months were selected so as to represent as closely as possible the different stages of development of the disease.

Three stages are distinguished : 1) the tissues seem impregnated with water over small portions of the bark ; small lesions and a few cracks appear from which a slight amount of gum exudes ;

2) The secretion of gum increases, the bark tissue hardens and cracks all over ;

3) Below the diseased part, the cambium forms a new parenchyma, and the diseased portions are ultimately completely eliminated, leaving a dry rough scar.

The first observations were made in May 1913 and afterwards repeated at intervals of three, ten and thirteen months.

Of the eighteen infected areas examined at the time the observations were begun, eight appeared already cured, while in the ten others the infection was in full course of development. Five of these latter always continued active, two recovered and then became active again, and finally three seemed fully healed at the end of the thirteenth month.

With regard to the eight other areas, healthy in appearance, four remained so for some time, in two the disease became active for some length of time, and the last two, with the disease in active progress, continued in this condition with extensive mortification of the tissues and abundant secretion of gum.

As will be seen, the development of the disease is very slow, with alternating active and passive phases, which may be related to variation in the degree of resistance of the plant attacked. When healing takes place, the whole of the infection has not been eliminated through the tissues of the host, but the pathological process appears to be arrested perhaps owing to the formation of new tissues which react with more intensity against the disease. This is the period of greatest resistance of the plant. Afterwards the continuation of the attacks, excessive production of fruit, and other factors also, weaken and exhaust the plant, lowering its resisting powers so that the infected area reverts to the active stage, and the disease spreads to the surrounding tissues.

The writer also carried out inoculation experiments with diseased tissue with cultures of *Diplodia natalensis* and with cultures of *Phomopsis Citri* both on young orange trees in pots and on adult plantation trees. No definite conclusions can be drawn from the results obtained, as it was not possible in any case to produce the formation of the characteristic infected areas. In the adult trees there was, it is true, a slight secretion of gum, with partial mortification of the tissues, but it was only for a very short time and over very limited extents of the bark. The results are still more negative in relation to young plants, which are undoubtedly endowed with a higher degree of resistance.

In the control experiments the best results were obtained by means of cupric paste and carbolineum :

(1) Cupric paste : solution of sulphate of copper and milk of lime in equal parts ; mix thoroughly, then add lime until the mixture acquires a certain consistency. The infected areas were cured in the proportion of 64 %.

(2) Carbolineum diluted in soap water : cures 60 %.

Before applying the antiseptic, it is necessary to cut away unflinchingly all the infected wood and the adjacent parts, and not to confine oneself to simply scraping and removal of the bark, as is usually done in the majority of cases.

804 - **Citrus Barkrot in the Philippines.** — ZERUST G. H. in *The Philippine Agricultural Review*, Vol. VIII, No. 2, pp. 95-97, Manila, 1915.

The appearance of the disease known as "citrus barkrot" has caused serious injury to the cultivation of citrus trees in the province of Batangas, Philippine Islands. This disease having broken out with special severity

After the eruption of the Taal volcano in January, 1911, many growers believed that the eruption, which defoliated the trees, is responsible for the outbreak.

The mandarin (*Citrus nobilis* Lour.) appears extremely susceptible to the disease. The "calamondin" (*C. mitis* Blanco) is also attacked, but with much less severity. The sweet orange (*C. Aurantium* L.) and the pomelo (*C. decumana* L.) are much more resistant than the mandarin to barkrot, being seldom attacked to a serious degree.

Barkrot has much in common with gummosis, with the difference that the disease is an exudation of sap instead of gum, and that young trees and seedlings are immune. The characteristic of barkrot in which it is similar to gummosis is that in some cases badly infected trees mature their fruit prematurely, the fruit showing a bright yellow colour while still very small. This is particularly noticeable in the mandarin, which usually does not colour well in the Philippines.

The disease makes its presence known by the oozing out of sap from the bark, which softens and forms a putrid sore, varying in size from one-half to 3 $\frac{1}{2}$ centimetres on the trunk and branches, generally at the height of $\frac{1}{2}$ to 1 $\frac{1}{2}$ metres from the ground, though the disease occurs as high as 3 to 4 metres on the larger branches. Where the outbreak is severe these spots occur thickly and finally unite, with the result that the tree or branch is quickly girdled. Numbers of insects are attracted to the sores by the putrid sap, and the spots are usually found to be infected with the larvae of various insects which keep up the irritation. As the tree strives to overcome the disease, the spots dry up, the edges of the sores begin to heal over, and the bark curls or scales. On brushing off the dead bark the new wood is seen forming on the edges of the sores, giving to badly affected branches a queer distorted appearance.

The term "barkrot" is to some extent misleading, as the disease does not originate in the bark. If the bark and cambium layer are cut away and the underlying wood carefully examined, a dark-coloured area, usually of a brown to a reddish tinge, is found. This extends into the wood to different depths. As in gummosis, the sap collects in small pockets between the wood and cambium layer until the bark is separated from the wood and finally split by the pressure within, so that the sap oozes out.

The Philippine Bureau of Science has carried on investigations on barkrot, but failed to find an organism to which the disease might be attributed. Apparently it is a physiological disease produced by unfavourable soil and cultural conditions. The irregularity of the water supply is also a factor.

Proper ploughing and cultivation varying in depth each year, and the sowing of leguminous cover crops during the rainy season, are apparently essential in the prevention and cure of barkrot. The cover crop should be cut and left as a mulch during the dry season. The treatment of the tree itself is a matter of secondary importance.

The earth round the tree should be thoroughly loosened and stirred. The diseased spots should be cut out down to the healthy wood, at once

painting the wound with a protective material. The Philippine Bureau of Agriculture has worked satisfactorily along the above lines, obtaining improvement which leaves little to be desired under this treatment.

805 - "Parch Blight" on Douglas Fir in Oregon. - MUNGER THORNTON T. in *The Plant World*, Vol. 19, No. 2, pp. 46-47. Baltimore, Md. February 1916.

Quite frequently, in the spring of the year, the foliage of the Douglas fir trees in the vicinity of Portland, Oregon, turns brown, and entire trees are sometimes as sere as though recently dead or dying. With the beginning of the growing season, however, most of the buds open normally and by midsummer the trees have regained their usual green appearance, many of the old needles dropping off.

The injury is generally limited to temporary inhibition of growth, with a slight loss of timber production. Isolated trees are more liable generally to the disease than dense groves. Exposed eastern sides of forest are more affected than the western sides in protected locations.

The blight is due to the dry east winds that occasionally sweep across the Cascade Mountains, the vicinity of Portland being particularly exposed to the direct sweep of these winds down the canyon of the Columbia river.

The Douglas fir (*Pseudotsuga Douglasii*) in this region is called the Cogburn form, and is particularly dependent upon a humid, mild climate, and consequently suffers from these hot, dry blasts, which cause excessive transpiration and produce the above injuries.

806 - Fruit Injury during the Fumigation of Citrus Trees: Causes and Remedies. - WOOLLEN R. S. in *The Fruit World of Australasia*, Vol. XVII, No. 3, pp. 70-72. Melbourne, March 1st, 1916.

The production of citrus fruits in Australia amounted in 1913-1914 1,341,878 bushels of oranges of the value of £ 497,286, while that of lemons was 297,083 bushels valued at £ 97,753. The problem of protecting citrus trees against their enemies therefore is of great importance. The method of control most in use is that of fumigation with hydrocyanic acid, a very effective system, but one which sometimes pits the fruits. The writer proposed to investigate methods of avoiding such injury. The pitting of fruit caused by hydrocyanic acid fumigation has been put down by specialists to various causes, such as sulphuric acid, the presence of nitric acid in the sulphuric acid, the too rapid evolution of the gas, the absorption of the gas by the water on the tree, an abrasion of the fruit produced by the tent placed over the tree, etc. The impurities contained in the two reagents used, however, potassium cyanide and sulphuric acid, are in such small quantities that they cannot produce any marked effect. On the other hand there can be no question of the pitting being caused by minute drops of sulphuric acid thrown off in the over-rapid evolution of the hydrocyanic acid, as in that case the injury would only affect the fruits placed lowest and in the immediate vicinity of the generator. The most seriously injured fruits, however, are those at the top, and sometimes they are the only one

(1) See also *B.*, June 1911, No. 1967.

injured. If fumigation is carried out before sunset the pitting is sometimes only found on the sunward side. Finally, if instead of sulphuric acid phosphoric acid, which is stable and has a very slow reaction is used, the extent of pitting is not in the least reduced nor, as the author ascertained experimentally, is it reduced when chemically pure hydrocyanic acid is employed. It may therefore be concluded with certainty that the pitting is caused by hydrocyanic acid and by no other cause. It depends : (1) on the quantity of gas used and the length of fumigation ; (2) on the condition of the plants treated ; (3) on atmospheric conditions.

Generally speaking, a plant weakened by gummosis, for instance, sustains more injury than a vigorous one. The pitting is more severe in fruits with thin skin, especially if the latter has recent abrasions. The Author found that on fruits pricked with a fine needle, then subjected to fumigation with chemically pure hydrocyanic acid, a depressed pitted zone always formed round the prick. Consequently the bulk of the injury arises from lesions occasioned during the pulling over of the tents.

The pitting is much more severe when fumigation is carried out : 1) during hot sunny days ; 2) when the temperature is near 32° Fahr ; 3) during exceptionally hot nights ; 4) when a strong wind blows and shakes the tents ; 5) during very wet nights.

Excessive moisture in itself occasions more injury than all the other factors together, precisely because it renders the tents more impermeable to gas and heavier, which increases the injury already sustained by the trees when they were pulled over.

The bulk of the injury therefore may be avoided by taking the following precautions : preventing the tents striking the trees as far as possible ; using poles higher than the trees to support the tents ; stopping the fumigation when the tents are heavy with wet or when the trees are wet ; carrying out no fumigation during over-hot days, or when windy, or when the temperature is too low (the author advises adopting 36° F. as the minimum temperature).

Trees sprayed with Bordeaux mixture may not be fumigated until a year later. Failure to observe this rule causes exfoliation. The Author never found any injury follow from fumigation following treatment with lime and sulphur solution.

DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

On the Original Range of *Spongospora subterranea*. — LYMAN G. R. and ROCKS L. E. in *Science*, New Series, Vol. XLII, No. 1090, pp. 1090-11, Lancaster, Pa., 1915.

The discovery of *Spongospora subterranea* by the Department of Agriculture of the United States on potatoes from Peru throws some light on the still unsettled question of the place of origin of this parasite. It is very widespread in Europe, and during the last three or four years has also

appeared in several parts of the United States (1) and Canada, causing extensive damage.

As was shown by the work of KUNKEL, the union between the plant host and the parasite is an extremely intimate one, which proves that the form of parasitism under consideration is of very ancient date.

The disease never assumes acute form, the destruction of the tissues being neither rapid nor complete, but the process of infiltration and destruction is slow, and a comparatively long time is required to overcome the resistance of the plant.

Specimens of the parasite were discovered by LAGERHEIM at Quit (Ecuador) in 1891. It was not stated, however, whether the disease was endemic or whether it came from Europe, where it has been known since 1884.

In the present case the potatoes were native to Peru, coming from the eastern slope of the Andes, the regions of Cuzco and Ollantaytambo at about 10,000 ft. altitude. Some of the infected tubers were even supplied direct by the Indians residing in a locality lying between the valleys of the Umbamba and the Lucumayo near the Panticalla Pass, at 12,000 ft. almost at the limit of potato cultivation. The presence of European materials in these isolated and remote spots must be set aside *a priori* therefore host and parasite would be indigenous to Peru. This hypothesis is further borne out by another fact: the spores which develop on the Peruvian varieties are much smaller than those found on the European and North American tubers. Generally the disease is much less severe, so much so that the natives pay no attention to it. In the course of time the host appears to acquire a power of resistance which counterbalances the pathogenic action of the *Spongospora*.

Thus two reasons suggest that South America, the place of origin of the potato, also gave birth to *S. subterranea*.

808 - Changes in the Chemical Composition of Rye Seed due to the Action of Certain Forms of *Fusarium*.— See No. 742 of this Bulletin.

809 - Experiments on Smut-resisting Powers of Different Varieties of Wheat. — V. KIRCHNER O. in *Zeitschrift für Pflanzenkrankheiten*, Year 1916, Vol. 26, No. 1, pp. 112. Stuttgart, April 22, 1916.

The writer has, since 1903, carried on cultivation experiments at Hohenheim, Germany, with 360 wheat varieties (241 winter and 119 summer varieties) for the purpose of studying their resistance to smut (*Tilletia tritici*). The varieties in question are common wheat (*Triticum vulgare*), dwarf wheat (*T. compactum*), rivet wheat (*T. turgidum*), hard wheat (*T. durum*), Polish wheat (*T. polonicum*), spelt (*T. Spelta*), two-grain wheat (*T. dicoccum*) and one-grain wheat (*T. monococcum*). The seed was brought into contact with fresh fungal spores, and sown on the same day with equal areas in each variety; the young plants were afterwards all given the same care and at the end of the experiment the number and percentage of diseased ears in all the varieties were determined. The majority of the varieties proved

(1) See B. February 1916, No. 246.

prone to the disease in the very first experiment that there was no necessity to test them again; others, showing greater resistance were re-tested 0 or more times.

It was found that there are only a few varieties possessing great resistance to the disease. Such are chiefly the winter wheats, including the earf and rivet wheats.

Among the 194 varieties of winter wheat studied, those belonging to the group *velutinum* Schübl. are the most resistant, namely: "Hohenheim 77" which was attacked 4 times during an experimental period of 7 years, "Fürst Hatzfeld" and also "Fürst Hatzfeld de Cimbal".

Among the winter spelt varieties there were 3 blue ones belonging to the group *Alefeldii* Körn. characterised by great resistance, namely "blue winter spelt with large square ear", "hairy blue spelt with loose square ear", and "hairy blue spelt with large square compact ear".

Summer wheat is slightly more resistant. Mention must be made especially among the 71 varieties of common autumn wheat tested, of the Galian varieties with large square ear, although they behaved somewhat differently in the different years of experiment. "Red Schlaustedt wheat" and a wheat obtained by pedigree crossing of the varieties "Bohemian Wechselweizen" \times "Richelle white early" gave a like result. The most resistant variety was the "beardless Odessa", which, being tested six times, on one occasion showed 0.56 % and on another 2.5 % of diseased ears.

Among the rivet wheats, the variety "smooth miracle red" which was tested 4 years in succession was entirely free from the disease.

The hard wheats were difficult to infect. Two of them especially are highly resistant, the "white hard smooth wheat with white awn" and the "white hard smooth wheat with black awn".

Among the Polish wheats which were also difficult to infect, mention must be made of the "large ear wheat" and "black awn wheat".

Among the 5 varieties of spelt wheat which were generally fairly immune, there were 2 blue ones which up to now never contracted the disease.

"The red summer one-grain wheat" was difficult to infect. In 8 experiments the "red hairy summer one-grain wheat" once had no spores and on another occasion had 0.77 % of diseased ears.

The writer then mentions some varieties of winter wheat particularly immune to the disease. They are: "Strube's hybrid No. 26" with 62.47 %, Strube's hybrid No. 210" with 62.98 %, "Buhlendorf wheat with earling brown grain" with 64.5 % and "Heines Teverson" with 85.77 % of diseased ears.

The least resistant summer wheats were: "Green mountain" with 12 % and "Rimpau red Schlaustedt" with 45.4 % of infected ears.

"White winter bearded spelt" had 44.87 % and the "two-grained winter white semi-awned" had 85.92 % of diseased ears.

Between the high susceptibility and low susceptibility groups are the other varieties tested. It is certain, therefore, that in addition to the varieties fairly or highly prone to the disease, there are others which rarely or

never contract it. These differences might perhaps be still more clearly shown if pure lines were used for experiment, which was not the case here.

These experiments have also proved that among some descriptions of one and the same variety of wheat, a certain agreement is found as regards their resisting powers to smut, but that this is not observed in the most important cultivated forms (ordinary and spelt). The experiments made with common wheat and spelt generally showed that when a wheat is resistant to smut, another belonging to the same botanical group does not necessarily behave in the same way. The degree of predisposition must rather be regarded as a character typical of the wheat under examination.

The author also endeavoured, by infection tests, to study the influence of external factors on the result of contamination with spores of the parasite. Even in the case of wheats which were regarded as prone to the disease the figures obtained in the different years for the same wheat differed greatly, sometimes falling to zero. It follows that the fact that an artificially infected wheat has not contracted the disease does not necessarily mean that it is refractory to it.

The great influence of external factors on the result of infection partly explains the contradictory observations made, especially by farmers, with regard to the smut-resisting powers of different wheats. In well-conducted experiments, however, a fair agreement of the different wheats is nevertheless observed. For instance, out of 17 wheats studied by the author and afterwards also tested by TUBEUF and HECKE, the same wheats were found prone or resistant to smut in all the investigations. The writer concludes that HECKE's opinion that resistance to the disease is in each wheat a constant character influenced by other factors is correct.

Assuming that the degree of resistance is a constant character of the wheat, it must be concluded that this character is hereditary. No such experiments as were undertaken for "rust" have as yet been carried out to determine whether susceptibility to the disease is hereditary. The writer does not think that the observations relating to rust can be extended to smut.

Without taking into account the question of heredity, the matter has already been made to clear up the matter of the greater or lesser resistance of certain wheats to smut. TUBEUF suggested that a relation might exist between resistance to smut and the rapidity of the germination of the wheat grains, those wheats which germinate rapidly being the more resistant. This opinion is also supported by APPEL and GASSNER, who claim to have actually found such a relation. The writer's experiments nevertheless have shown that these results do not admit of generalisation and that at any rate this relation does not exist in a large number of common wheats, hard wheat, winter and summer spelts. HECKE obtained the same result. Nor is there any relation between the germinating capacity and the smut resistance as was proved by the writer.

The difference in smut-resistance is thought by the writer to be due rather to differences in the chemical composition of the plantlets. The observations in respect to various diseases (rust, mildew, etc.), showing that

most resistant wheats have a different chemical composition from those of low resistance, speak in favour of this hypothesis.

In order to test this hypothesis, the author studied the acid content of wheats differing clearly in their smut resistance. These were young plants of the "Richmond giant wheat" (highly liable to the disease) and "Fürst Latzfeld" (highly resistant) which are morphologically identical. It was found that the resistant plants contained more acid than the susceptible ones. The absolute difference is small, but deserves to be pointed out, especially as the morphological characters of the conditions of growth of the two plantlets were the same. It may therefore be concluded from this experiment that there is a relation between the acid content and the resistance to smut.

o - **Variations in the Resistance of Vines to Mildew.** — RAVAZ L. and OBEDOFF S. in *Le Progrès agricole et viticole*, 33rd Year, No. 10, pp. 441-447, Fig. 1-6, Montpellier, May 7, 1915.

Though common to all vine varieties, the disease varies considerably in intensity according to the variety. What is the cause of this difference of behaviour?

It is well known that the stomata are the only channel through which the hyphae of the parasite can enter. The writers, by a large number of experiments, determined exactly the average number of stomata per unit surface of the leaf stems and petals of many kinds of vines, both French and American, without discovering any relation between the degree of resistance to mildew and the number of stomata. In any case the ratio would if anything be inverse, as there is a relatively larger number of stomata on the corresponding parts of American vines which are well known to have a high degree of resistance, while French vines, very liable to the disease, have fewer stomata.

The degree of attack of the vines is to be explained rather by the more or less early character of the types, and also the time when infection becomes apparent. When the leaf stems are very soft and herbaceous and still in process of growth the disease develops rapidly, causing the axes of the florescences to droop and partial rot of the tissues. Later on, on the other hand, when the leaf stems are partially lignified they become highly resistant. The fungus develops for preference on the young organs or on those in course of growth, as for instance on newly formed flowers and leaves.

1 - **Morphology and Conditions of Development of the "Sclerotium Disease of Clover" (*Sclerotinia trifoliorum*).** — PEGLION VITTORIO in *Rendiconto delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th Series, Vol. XXV, 1st Half-Year, Part 7, pp. 521-524, Rome, April 2, 1910.

Among other questions in connection with *Sclerotinia trifoliorum*, which causes considerable damage to clover fields, especially in northern Europe, no solution has yet been reached with regard to those concerning conidial or micro-conidial stage of this fungus and the conditions causing the epidemic outbreak of the disease in clover fields. The writer undertook the study of *S. trifoliorum* in order to solve these problems.

On a small plot under white clover (*Trifolium repens*) destroyed this parasite, it was found that from the many sclerotia remaining on the ground, owing to break-up of the neck and stalks of clover, innumerable apothecia began to grow towards the end of October, and continued to appear in the first fortnight of November.

On placing a few ripe apothecia in Petri dishes the spores are found to be scattered in small heaps a few hours later. Each of these heaps is made up of the 8 spores contained in each ascus. As soon as disseminated, the ascospores are ready to germinate, both in distilled water and in ordinary nutrient media. *Scl. trifoliorum* is psychrophile. At a relatively low temperature (8° to 10° C.) it rapidly penetrates the entire mass of medium, and in a short time gives rise to many sclerotia. The fragments of mycelium serve perfectly well for transplantation of the fungus in the pure state.

In spreading fragments of mycelium from pure gelatine cultures on potted earth sown with common forage pulses (clover, lucerne, fenugreek) the young plants are rapidly destroyed in proportion as they grow. *Scl. trifoliorum* forms a sort of inconspicuous network or spider's web, which spreads on the surface of the soil, surrounds the base of the young stalk and causes its disintegration. The young plants lodge, and in a few days the differentiation of the conidiophores is seen to take place on them. The young plants are liable to infection during the entire germinating phase. As soon as the first leaves have formed, the receptivity appears to cease.

This fungus may also attack the bean, causing a disease with the same characteristics as that attributed to *Scl. libertiana*. The author concludes from the results of experimental infections that the injuries attributed to the latter are also sometimes caused by *Scl. trifoliorum*.

Trial was made of several means of causing the germination of the sporidia springing from the mycelium, but in this as in previous experiments the results were negative.

During years taking a regular course and in which grass crops are not affected by frosts, the "sclerotium disease of clover" does not occur. On the other hand, when vegetation is still active at the onset of frosts the latter soften or injure the tissues and thus facilitate penetration by the growth of the *Scl. trifoliorum*, the apothecia and ascospores of which effect their differentiation even towards the end of autumn, the fungus being markedly psychrophile.

812—*Ustilina zonata* on *Hevea brasiliensis* in the Federated Malay States (1) — SHARPLES A., in *The Agricultural Bulletin of the Federated Malay States*, Vol. IV, No. 1, pp. 98-105. Singapore, January 1916.

Ustilina zonata (Lév.) Sacc. caused extensive damage in 1915. It spread more and more in *Hevea brasiliensis* plantations in the Federated Malay States.

It has been noted that the attacks of boring insects are almost always accompanied by the presence of fungi. The latter, by weakening the wood, facilitate the boring of the tunnels both by the larvae and the adults. The

(1) See B. Sept. 1915, No. 681.

fungus in turn utilises these hollowed out parts to penetrate downwards. This double attack often kills the tree, and the injury thus occasioned, especially in 10 to 12 year old plantations, is at times very great.

Means of control: 1) cut off the diseased parts unsparingly and tar the wound; 2) dig out and destroy old stumps, which are more often than not a source of propagation of the disease.

13 - **Fungoid Diseases of the Sugarcane at Tucuman (Argentina).** — CHAVANNE JUAN, J. in *Ministerio de Agricultura de la Nación, Dirección General de Enseñanza e Investigaciones Agrícolas, Sección Escuelas Especiales*, Year 1916, No. 51, pp. 5-32, 2 Pl. Buenos-Ayres 1916.

A list and description of the fungoid diseases which attack the sugarcane at Tucuman.

1) "Polvillo" or "gangrena humeda". — According to the writer, this disease is identical with the "top-rot" ("pokkahbong"), already discovered and studied without much result up to now in various sugarcane-growing countries (Java, Mauritius, Demerara, etc.). The infected plants can at once be detected by their chlorotic appearance; the leaves lose their gloss and rigidity, the apex droops, the tops of the canes show marked signs of disease which increase and spread downwards along the stalk. The infection spreads from without inwards, and from the young to the older portions of the plant. It attacks the base of the leaves, blocks up the veins and thus prevents circulation of the lymph elaborated in the leaf substance. The infected sheaths become leathery and stiff, thereby hindering the growth of the stalk. Although the pathological evidence as a whole points very strongly to a bacterial cause, the almost constant presence of larvae or other small organisms in the infected tissues suggests that these animal parasites may play an important part in the growth and spread of the disease. The larvae met with most frequently are those of diptera almost all belonging to one species, namely: *Euxesta chavannei* (1) and *E. argentina* Brèthes. If larvae of these diptera taken from diseased plants are introduced into a deep wound produced artificially in the region of the terminal bud, the characteristic symptoms of "polvillo" will eventually occur. A number of lengthy experiments in field and laboratory were carried out in order to discover the cause of this disease. It is contended that there is no specific bacterium of the disease, or obligate parasite the action of which is alone sufficient to rot the crown of the cane, but that it is due to decomposition produced by various micro-organisms not yet determined, which penetrate the plant through lesions caused by insects or other agencies.

It is hardly possible to ascertain accurately the origin of this disease in the Tucuman plantations, the data available only relating to these years when, as in 1893-1894, "polvillo" attained large proportions and wrought considerable havoc. The cultivated sugar cane varieties are not all equally liable. Some kinds brought from Java ("P. O. Java 36" and "P. O. Java 13") as also "Cayana Roxa", "Verde de las Antillas", and "Sin Nombre" are distinguished by a high degree of resistance.

(1) See B. Nov. 1914, No. 1079.

2) *Cercospora Kopkei* ("enfermedad de las manchas rojizas"). — In spring and autumn, especially during the rainy season, the occurrence is frequently noted in the plantation of oblong red spots, irregular in outline extending over the leaves. When the infection is severe it causes withering. On keeping the infested leaves in a very moist atmosphere, growth of the hyphae of the mycelium of the pathogenic agent, *Cercospora Kopkei*, is soon induced. Using cultures of this fungus it is very easy to produce the disease artificially, though it does not cause great damage, at any rate in the plantations of Tucuman. In any case, it is effectively controlled by means of Bordeaux mixture applied only to the outer and most exposed parts of the plantation, where wind-borne conidia are usually deposited.

(3) *Leptosphaeria Sacchari* ("enfermedad de las manchas anulares"). Oval blotches, 3 mm. in width and 7 to 9 mm. in length, appear on the leaves attacked by this fungus. In an advanced stage of the disease these blotches are white or yellow, dry in the centre and darkest at the edge. The damage caused by *Leptosphaeria* is mostly inconsiderable. For control, it is advised that all the infected parts should be gathered and burnt.

The author also mentions: *Physalospora tucumaniensis* Speg. in Florida at San Pablo and in New Bavaria; it attacks old and dying leaves, and therefore does no very great harm; *Venturia sterilis* Speg., *Phyllosticta Sacchari* Speg., *Melanconium Sacchari* Massee; *Glenospora Sacchari* Speg., *Fumigaria Sacchari* Speg., and *Colletotrichum falcatum* Went., the presence of which however has not yet been definitely established.

81. — **Fungus Diseases of Coffee in Malaya.** — BELGRAVE W. N. C. in *The Agricultural Journal of the Federated Malay States*, Vol. IV, No. 4, pp. 111-113, Singapore, January 1903.

The coffee disease known as "leaf spot" caused by *Hemileia vastatrix* occurs locally in Malaya, but not to any considerable extent. The fungus of the genera *Hyalopus* and *Cephalosporium* probably batten on the Hemileia and are always found on the ripe patches of this rust.

The foliage is also attacked but less seriously, by *Phyllosticta coffeae*, *Coniothyrium Coffeae* and a species of *Colletotrichum*.

Among diseases of the stem is the one called "die-back", which is of no economic importance. On sectioning the woody mass of the infected parts, it is seen to be completely over-run by interwoven hyphae belonging to two fungi of the genera *Diplodia* and *Colletotrichum*.

The mycelium of a basidiomycete, the fructifications of which have not yet been discovered, sometimes develops between the bark and wood of the roots, rotting and destroying the tissue.

There are often found, especially on the "robusta" berries, epithelial spots and lesions due, according to ZIMMERMANN, to the action of weather agencies. They do not injure the coffee, but may lead to the attack of dangerous fungous diseases.

Among the fungi observed on the fruits may be mentioned: *Pestalotia Coffeae*, *Hemileia vastatrix* and species of the genera *Stilbum*, *Fusarium*, *Coniothyrium* and *Capnodium*, the latter in conjunction with scale insects.

5 - *Ascochyta hortorum*, a new Pest of the Artichoke in Italy. — GABOTTO L. in *Rivista di Patologia vegetale*, VIIIth Year, No. 2, pp. 45-46. Pavia, March 1916.

In February 1916, the Author observed the presence of *Ascochyta hortorum* (Speg.) Smith on artichokes from the Italian Riviera in the neighbourhood of Genoa. The infested artichokes were only half the normal size and badly damaged. An enormous quantity of brown pycnidia were found (the scales attacked, on the peduncles and inside the rotting receptacles. In any bacterial forms were combined with the fungus.

A. hortorum, already reported on several kitchen-garden Solanaceae (1), had not been met with on artichokes. Apparently it has undertaken the conquest of new hosts even belonging to different plant families, which renders it still more formidable.

6. *Septoria Apii* var. *Magnusiana* and *S. Apii-Graveolentis* n. sp., injurious to Celery in the Neighbourhood of Petrograd. — DOROGIN G. in *Материалы к изучению болезни. Вспомогательная и Фитопатологическая Народно-научная Материалы по Микологии и Фитопатологии России*. Ministry of Agriculture, Office of Mycology and Plant Pathology of the Scientific Committee. Materials relating to Mycology and Plant Pathology, 1st Year, Part 4, pp. 57-75. Petrograd, 1915.

In a garden near Volkor, Petrograd, a large number of adult celery plants were observed to be affected with a disease the most conspicuous symptom of which is numerous spots on the foliage. In July this disease appeared sporadically on separate plots and beds, and in August the appearance of the diseased areas was very unsatisfactory.

The diseased plants of the different groups presented such divergent characters as to suggest many distinct pathogenic agents. Microscopic observations however only disclosed two species of *Septoria*, which are dealt with in the present work.

The plants attacked by the same parasite may present different symptoms according to cultivation or seasonal conditions, as was ascertained by comparing one year with another or separate distant places, but in the present instance the most divergent symptoms appeared simultaneously and in the same place under quite identical conditions of environment for all plants and groups.

One of the *Septoria* might be identified with *S. Magnusiana* All. (= *Phyllosticta Magnusiana* [All.] Bres.), but the writer, as a result of a careful examination of the morphological and physiological characters, proposes to regard it as a simple variant of *S. Apii* (Br. and Cav.) Chester (= *S. Apii* Br. and Cav.) Rostk.; we should thus have: *Septoria Apii* (Br. et Cav.) Chester var. *Magnusiana* (All.).

The disease caused by this fungus occurs in three different aspects: 1) round red blotches, 5 to 10 mm in diameter, darker towards the edges; 2) pycnidia scattered in the blotches, towards the end of the leaves; 3) ochre blotches, pale, bordered with yellow; 4) greyish-white blotches with many pycnidia. The blotches may sometimes be completely absent and the pycnidia gathered in small groups spread over the leaf surface.

(1) See *ib.* April 1912, No. 745.

The other *Septoria* could not be identified with any hitherto known form and is described as a new species under the name of *Septoria Apii graveolentis* n. sp.

The symptoms of the disease are very varied : 1) inconspicuous light yellow spots, diameter 0.5 to 3 mm, the pycnidia spread over the entire leaf on the spots and outside, separately and in groups ; 2) spots of vague outline, reddish-yellow in colour ; the pycnidia, few in number, are first restricted to the leaf tissues, afterwards partly emerging ; 3) round spots dirty yellow, maximum diameter 5 mm, in which the pycnidia are situated ; 4) dark chestnut spots, lighter towards the centre, strewn with pycnidia.

Both with *Septoria Apii* (Br. and Cav.) Chester var. *Magnusiana* and *S. Apii graveolentis* n. sp., the disease begins with the lowest leaves ; these turn yellow without completely withering or drying up. Weather conditions have some influence on the growth and spread of the fungus. After a severe epidemic in 1913, the disease reappeared in the summer of 1914, but disappeared almost at once owing to the drought which prevented germination of the spores.

The *Septoria* have no type of fructification other than the pycnidia. The latter form during the summer, but their spores retain their germinating capacity through the winter and spring. Infected leaves and other vegetable debris remaining on the ground may thus become the source of an epidemic in the following year. The pycnidia also develop in the seeds. They contaminate the young plants from the latter, and eventually, after an incubation period of three or four weeks, produce the characteristic degeneration of the leaf in the already transplanted and growing plants.

The following means of control are advised : 1) careful and thorough examination of seeds ; 2) treatment of seeds with dilute formalin, strength 1 : 300, for 2 hours ; 3) removal from seed plots and destruction of all young plants showing light yellow streaks ; 4) picking off the diseased leaves during the summer and pulling up the entire plant in case of very widespread and marked infection ; 5) gathering and destruction of all vegetable refuse after the crop.

Finally, attention is drawn to the fact that this refuse must not be used as manure, even if the infection was very slight and only involved a small number of plants.

817 - **A New Disease of the Bamboo caused by *Scirrhia bambusae* n. sp., in Italy**

— TURCONI MALUSIO in *Rendiconti delle sedute della Reale Accademia dei Lincei, Class. di scienze fisiche, matematiche e naturali*, 5th Series, Vol. XXV, 1st Half-Year, Part 1, pp. 528-532. Rome, April 2, 1916.

In a plantation of *Bambusa mitis* Poir. in the Botanical Gardens of Pavia, during the summer of 1914 the branches were wholly or partially dried up, whitish in colour and showed a number of small black blisters. The first symptoms of the disease appeared on branches and twigs of all sizes, preferably at the tip, chiefly on the small branches carrying leaves. Small brownish spots or streaks appear and these afterwards spread and combine, forming blotches which finally occupy several internodes. The diseased parts, which are brown at first, gradually turn whitish and dry, becoming

covered at the same time with the characteristic small black blisters. The disease usually extends from the tip towards the base of the branches; sometimes the infection is confined to the internodes and the middle or base. In these cases the portion of the branch above the infected part dies and dries away, without showing the characteristic fructifications of the parasite, which only form in the infected parts after their death.

This disease is caused by the parasitism of a new species of *Dothigaceae*, of which a description is given in the asclephore form under the name *Scirrhia Bambusae* n. sp. and in the conidial form under the name of *Helanconium Bambusae* n. sp.

The disease was reproduced by artificially infecting *B. mitis* and *B. acclis* Hort. with the fungus.

8 - ***Ascochyta clematidina*, on Stems and Leaves of Clematis.** - GLOYER, W. O. in *New York Agricultural Experiment Station, Geneva, Technical Bulletin No. 44*, pp. 3-14. Plates I-IV. Washington, 1915.

The rotting of the stems and mottling of the leaves of *Clematis* are due to the fungus *Ascochyta clematidina* (Thümen).

The disease first occurs in the form of blotches on the surface of the leaves. On drying, these blotches take on a dark chestnut colouration, with red margins. From the leaf the mycelium makes its way down the length of the petiole as far as the axil where it develops in the surrounding tissue, forming a continuous zone of infection which causes the death of the portions of the plant above this point. The parasite may also develop directly on damaged epithelium in the neighbourhood of the leaf axil.

In both cases new buds and shoots continue to develop below the infected region, until the mycelium of the fungus, spreading downwards towards the base of the plant, eventually infects the whole of the aerial portion and causes the death of the host.

Hibernation in the open, whether in artificial culture or in infected vegetable debris, does not destroy the parasite. As soon as the temperature permits, growth recommences.

A. clematidina is easily isolated and develops readily in any of the usual media. Inoculations with pure cultures (mycelium) into *Clematis paniculata* and *C. Jackmanni* gave positive results, and the mycelium derived from artificially infected plants and inoculated on healthy specimens readily reproduced the disease.

A. clematidina is clearly distinct from other more common species and inoculation experiments on pumpkins, beans, peas and elms gave negative results.

Sprays containing the spores of the parasite in suspension produce the characteristic blotches on the leaves of *Clematis*, especially when the temperature is about 73° F.

The following methods of control are recommended: 1) transplantation to the open when one year old, allowing sufficient space between the plants and access of air, sun, etc.; 2) cutting and destroying all infected portions, subsequently spraying lightly with fungicides. The following mixture is

recommended: Sulphur 1 lb, soft soap 6 lbs, water 12 $\frac{1}{2}$ gallons; 3) remove and destroy all vegetable remains among which the parasite is capable of living as a saprophyte.

819 - **Investigations into a Disease of the Cones of *Pinus pinea* in Italy.** — PETRI, L. and ADANI A. in *Annali della R. Accademia di Agricoltura di Torino*, Vol. LIX, 23 pp. 12 Fig., 1 Pl. Turin, 1916.

The disease of the cones of *Pinus Pinea* L., long known to gatherers of cones in the pine groves of Migliarino, San Rossore, Cecina and Castel Fusano, under the name of "pine gallerone" and "pine pagliose", are due to the same identical pathogenic agent. The symptoms caused by the latter however differ to some considerable extent, according to whether the disease develops in autumn or spring.

"Pine gallerone". — An ochre hued spot first appears in May or June and from the line of contact between two adjoining scales rapidly spreads right through the cone. The loss of water being fairly large, the outer surface of the scales appears shrunken. Resin exudes here and there from the blackest portions. At the points where the infection is oldest, black pustules of irregular shape form, pushing up and splitting the epiderm of the scales. The shell of the seeds is normal, but the kernel is reduced to a grey or yellowish powder. The weight of these cones is lighter than that of healthy cones which have reached the same stage of development.

The browning of the scale tissue and the destruction of the kernels are accompanied by the presence of the mycelium of a fungus, which spreads from the upper surface of the scales through their thickness and penetrates the endosperm of the seeds, the oily substance of which appears to act as a powerful stimulant on the mycelium in question. The black external blisters are the pycnidia of the fungus, which may be classified as a new species of *Sphaeropsis* (*Sph. necatrix* Petri et Adani).

"Pine pagliose". — The first spots marking the infection are observable in September and throughout the month of October. The external characters of the diseased cones do not differ very much from those of the "pine gallerone". Thus, the discolouration of the scales, the exudation of resin, destruction of the endosperm, the presence of the mycelium and the pycnidia of *Sphaeropsis* are characters common to the two forms of degeneration in "pine pagliose" however the weight is equal, or nearly so, to that of healthy cones, the surface of the scales does not shrink, a number of seeds remain intact and retain their commercial value.

In these cones, owing to the more advanced lignification of the tissue and the less favourable season, the infection proceeds more slowly; it was therefore easier to ascertain the course it takes inside the cone. The mycelium penetrates between the scales and rapidly attacks the soft parenchyma which envelopes the seed. From this point it spreads through the thickness of the scale towards the lower (external) surface from which the sporogenous organs afterwards escape.

From what has just been said, it will readily be understood that the two names given by pine cone gatherers to the diseased cones only correspond to two slightly different aspects produced by the same pathogenic cause.

the nearly ripe cones, according to whether they are attacked in spring or autumn. It is quite natural that cones attacked in May or June when the tissues are soft and growth is still in progress should suffer a large loss of water, and consequently be very light; besides the seeds must obviously suffer as a whole from the consequence of the infection owing to the fact that between spring and autumn there is plenty of time for the parasite to exert a destructive action on the entire cone. On the other hand, when the infection occurs in autumn, just before the cones are gathered, the time available for the parasite to encroach on the seeds is very short, both because the spread of the mycelium is hindered by the thoroughly lignified and fully developed tissues, and because the drying of the cones for the purpose of extracting the seeds stops the further spread of the mycelium. If, however, owing to favourable circumstances, the infection is able to continue for a long time, the cones attacked in autumn ("pine pagliose") may have numerous features in common with those attacked in the spring ("pine gallerone").

The immediate cause of the disease is *Sph. necatrix*. This is proved not only by microscopic examination, but also by experiments of inoculation on healthy cones, in which the disease was successfully reproduced in this way.

As regards means of control, the following are advised: 1) complete gathering and burning of the diseased cones; this precaution must be strongly recommended to pine cone gatherers, who often omit to gather the pine gallerone" which are richer in pycnidia of the parasite than the pine pagliose". The cones of the "pine gallerone" should even be gathered as early as June, when dispersion of the spores has already begun, because on this depends in part the intensity of autumn infection; 2) thinning out the pine grove as much as possible, so that the plants are under the most favourable conditions and get the largest possible quantity of light and air. There should therefore be a distance of at least 33 feet between the left plants; very dense old pine woods in which there are from 100-110 trees per acre are the worst sufferers from this disease.

10 - Common Phosphorescent Toadstool (*Pleurotus nidiformis*) and "Sticky timber Pholiote" (*Pholiota adiposa*), Agaricineae attacking Wood, in Australia. — CLELAND J. BURTON and CHEEL EDWIN in *Agricultural Gazette of New South Wales*, Vol. XXVII, 3rd. Part, pp. 201-202, Pl. 5-6. Sydney, March 2, 1916.

A description of *Pleurotus nidiformis* Berk. (common phosphorescent toadstool) and *Pholiota adiposa* Fries ("sticky timber pholiote"), which destroy the wood by piercing it with their mycelial filaments and thus bringing about decomposition.

The former occurs widely in all the States of the Australian Commonwealth. It grows at the foot of living tree trunks (Eucalyptus and other species) or on dead stems. It is perhaps of no great economic importance, nevertheless, it would be advisable to destroy it by burning wherever found. It has been described by various authors under different names: *candescens*, *P. lampas*, *P. phosphoreus* and *P. illuminans*.

Pholiota adiposa appears on the trunks of trees at a height which may be 22 ft and more. In Europe this fungus is very injurious. In Australia

it is found only at one point in New South Wales in dense wood Mount Wilson, where it was perhaps introduced with European tree species. It has also been reported in Queensland. It is recommended to destroy by fire whenever found, in order to extirpate it completely from Australia while still very rare there.

WEEDS AND PARASITIC FLOWERING PLANTS.

821 — **Goatsrue (*Galega officinalis*), a Weed in New Zealand.** — COCKAYNE, A. in *The Journal of Agriculture*, Vol. XII, No. 2, pp. 125-130, 1 Pl. Wellington, February, 1916.

The Noxious Weeds Act, which has been in force for more than sixty years in New Zealand, makes the destruction of certain plants obligatory. Some of these are regarded as noxious throughout New Zealand others only in certain districts, according to a declaration by the local authorities.

The goatsrue (*Galega officinalis*) has also just been included in the latter category.

This species of Leguminosae cultivated in gardens in several parts New Zealand, has only become wild on the banks and in the old alluvial soil of the rivers Manawatu and Pohangina. It spreads rapidly along roads paved with the gravel of these rivers. As usually, *Galega* is not eaten in sufficient quantities by animals to prevent it flowering, it spreads rapidly wherever it takes hold, unless the soil is covered with a thick coating of grass. In New Zealand, the *Galega* often attains 3 1/4 ft. and more in height. It generally flowers towards the second week in December and remains in flower for about two months. If mown a little before flowering, it flowers in March if the plants are cut at intervals, they may even flower three times in one season. The ordinary method, therefore, which consists in preventing the flowering of weeds by a single mowing per year, is almost valueless for this weed, which must be turned in.

The *Galega* is regarded as a weed because: 1) it is very little liked by cattle; 2) it tends to choke more desirable plants; 3) it is considered poisonous.

Towards the end of autumn and in winter, animals feed to some small extent on the branches of the plant when they begin to dry. The same is the case at the beginning of spring, before the branches harden.

On the other hand, all animals refuse the plant during summer, when it is in full vigour. This seems to be due to the bitterness of its leaves. Moreover, at some seasons its leaves are markedly poisonous to sheep, and perhaps also to young cattle. Experiments in France have shown that 1 lb. of these leaves are sufficient to kill a sheep.

Goatsrue, however, has some useful properties. It has even been advised as a forage crop, and is in fact cultivated for that purpose in some parts of Switzerland. If mown when still tender and allowed to wither slightly it is agreeable to cattle and may be fed to them without danger.

The writer thinks that Goastrue would do excellent service as green manure, especially for very light sandy soils, for which it would perhaps be better even than lupin. It only remains to ascertain whether turning in would suffice to destroy it. Goastrue is plentifully provided with root tubers.

To control this weed, it must be mown at least three times a year, or turned in and a mixture of grass consisting principally of *Dactylis glomerata* and *Lolium italicum* sown on top. It would also be as well, for some time, to roll the grass-land thoroughly. In those parts where the plant specially abounds, clearing of the grass-land and conversion into arable land is advisable.

INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

822 — **The Entomological Society of Moscow, Russia.** — I. BOLDIREV V. P. History of the Foundation of the Entomological Society of Moscow, in *Известия Московского Энтомологического Общества* (Bulletin of the Entomological Society of Moscow), Vol. I, pp. 9-13, Moscow, 1915. — II. KULAGIN N. M. Programme of Work of the Entomological Society of Moscow, *Ibid.*, pp. 1-8.

The Entomological Society of Moscow, the third of its kind in Russia, was founded in 1913. It owes its formation to the combination of three Associations of Entomologists of Moscow which had until then existed separately.

After referring to the importance of insects to agriculture, the writer adds that the Society has two methods of achieving its object, one is that of enriching science by means of original research, the other the spread of scientific knowledge and training of young scientists.

As regards its practical aims the new Society has already made its first contribution by instituting a short course (from the 16th February to the 10th March 1915) for the training of a technical staff in the control of locusts and field voles. The number of persons attending the lectures was about 150. Most of the hearers consisted of male and female students of the Higher Schools of Moscow.

The said Society has its own organ: *Известия Московского Энтомологического Общества* (Bulletin of the Entomological Society of Moscow), the first volume of which appeared in 1915. In addition to original work, annual reviews of the literature relating to entomology are to occupy a large space in this publication.

823 — **Insect Pests of Plants Cultivated in European Russia, in 1914** (1). — KULAGIN N. in *Известия Московского Энтомологического Общества* (Bulletin of the Moscow Entomological Society) Vol. I, pp. 136-161, Moscow, 1915.

The above contains a summary of the facts scattered throughout Russian literature regarding the insect pests of cultivated plants reported in

(1) See the article by the same writer: "The principal Insect Pests of Plants cultivated in European Russia during the last twenty years", in *Ежегодник Главного Управления Землеустройства и Земледелия по Департаменту Земледелия*, (Year Book of the Department of Agriculture), IVth Year, pp. 585-638, Petrograd, 1913; and the article by PORTCHENKO I. A., *Ibid.*, VIIth year, pp. 348-360, Petrograd, 1914. (Ed.)

1914 in different parts of European Russia. The question of the type of weather in that year is also discussed.

The year 1914 was exceptionally abnormal. The second half of the winter of 1913-1914 was exceedingly warm throughout Russia, and little snow fell, except in the governments of the north-east and east. Thus in January, the mean temperature in Southern Russia was 6° C (10. 8° F. above the normal. February was exceedingly warm. The positive fluctuations amounted to 9° C (16. 2° F) in the central and south-eastern parts of Russia. The spring became dry with the return of cold. The first half of the summer (June, July) was very hot and dry in northern and middle Russia. The south, and particularly the south-west, suffered from torrential rains. The second half of the summer was very cool. In August, the temperature was 4° C (7. 2° F) below the normal (in the central governments). In eastern Russia the rainfall was much above the normal, while in the western part the drought continued. The first half of the autumn, up to the 10th October was rather rainy, but soon afterwards anticyclonic conditions became established. From September to November the temperature was below the normal throughout the country. It may therefore be said that the year was not favourable to insect development; the early spring, the return of cold during that season and afterwards the drought, all being unfavourable factors.

Among insect pests in 1914 Elateridae occur most widely; injury caused by them was reported in 18 governments with different climatic conditions (e. g. Moscow and Astrakhan). It was not possible to ascertain the number of species in question. In any case the presence of several species was reported in the government of Kaluga.

The most serious damage was caused by the following insects: *Onia* (*Tapinostola*) *musculosa* Hb.; *Euxoa* (*Agrotis*) *scythia* Schiff. (governments of Ekaterinoslav and Astrakhan); *Pirautia nubialis* Hb.; Elateridae; *Lema menalopa* L.; *Anisoplia austriaca* Herbst; *Oscinella frit* L. (government of Orel); *Cephus pigmaeus* L. (government of Ekaterinoslav), and locusts.

The insect pests reported in Central Russia exclusively were as follows: *Feltia* (*Agrotis*) *exclamationis* Schiff.; *Hydrocia nictitans* Bkh.; *Ochsenheimeria laurella* Schiff.; *Lasioptera cerealis* Lind. and *Apion* sp.

Phlyctenodes sticticalis L. was recorded in 9 governments, but only caused injury in that of Kuban, and, to a less extent, in that of Kharkov.

Below is a detailed list of the insect pests, in which, for the sake of brevity the name of the town stands for that of the government where the injury was caused.

I) COLEOPTERA. — (1) *Zabrus blaptoides* Kreutz. and *Z. tenebrioides* Goeze, both attacking wheat, the former in Ekaterinoslav, the latter in Bessarabia; (2) *Ophonus calceatus* Duft. at Ekaterinoslav on *Setaria germanica*; (3) *Blitophaga undata* Müll., at Stavropol. on the young leaves of barley and wheat; (4) *Meligethes aeneus* F., at Kiev, on wheat, on flowers of saffron *Salix*, *Caltha* and *Viola*; in Bessarabia on the floral buds of *Brassica Rapa oleifera*; (5) Elateridae were reported at Petrograd, Novgorod, Pskov, Viatka, Perm and in Livonia; *Agriotes lineatus* L. caused extensive damage

spring cereals, at Moscow; at Kaluga the following species were observed : *monitus aeruginosus* Oliv. ; *Agriotes lineatus* L. ; *A. sputator* L. and, to a great extent, *A. obscurus* L. and *Athous niger* L. ; at Orel together with *A. niger*, a few specimens of *Athous niger* L. were recorded ; Elateridae were reported at Tula and Riazan ; at Kharkov, *Agriotes* sp. (?) caused injury to wheat (160 acres were resown) and to cabbages ; at Kiev, beets were attacked by the adult *A. lineatus* ; in Podolia, by *Athous*, *Limoni*, *Melanus* and *A. lineatus* ; at Ekaterinoslav, *A. lineatus* and *A. niger* caused great injury to wheat and maize ; at Astrakhan, *A. lineatus* produced wide injury to rye (in April) and to different kinds of melons (May and June) ; in Bessarabia, *A. ustulatus* was found on the ears of barley ; (6) *Omophilus lepturoides* Fabr., in Bessarabia, devoured young heads of rye ; (7) *Podosta nigra* F. was observed in fairly large numbers on the ears of wheat at Ekaterinoslav, its injurious action in relation to grain crops however is not yet quite clear ; in the government of Kuban, it caused injury to beet ; at Stavropol it was found in quantities in grain fields, on *Bassia*, *Rapa oleifera* and other plants ; (8) *Opatrum sabulosum* L., at Kiev, Astrakhan and Kharkov, caused injury to peas, melons, water-melons, cucumbers and young wheat plants ; (9) *Gonocephalum pusillum* Fabr., at Astrakhan, attacked plots sown with wheat ; (10) *Crioceris meridigera* L., at Kiev, attacked asparagus and onions ; (11) *Lema melanopa* L. caused injury to grain crops at Kharkov, Kiev, Stavropol, in Bessarabia and the Crimea ; (12) *Chortocnema horrensis* Geoffr., in larval form, was found in the stalk of barley at Kiev ; (13) *Chortocnema* sp. was reported at Stavropol ; (14) *Psylliodes attenuatus* Ach. caused injury to young hemp plants at Orel and in Bessarabia ; (15) *Haltica cuphorbiae* Fabr. was observed at Ekaterinoslav ; (16) *H. olivacea* L., at Riazan, caused great damage to lucerne ; (17) *Cassida nebulosa* L., at Kiev, Kharkov and Ekaterinoslav caused damage to the beet ; it was also found on maize at Ekaterinoslav ; (18) *Larva (Bruchus) pisi* L., at Riazan, caused great injury to newly sown peas ; it was also met with at Ekaterinoslav ; (19) *Otiorrhynchus ligustici* L., at Tchernigov, in the larval stage, injured roots of clover ; at Kharkov it attacked clover and lucerne ; at Kheron, the roots of lucerne ; at Kiev, the adults preferred the leaves of the peas to those of the beet ; at Stavropol this species was found on the leaves and roots of lucerne ; (20) *Sitones lineata* L., at Orel, Riazan and Kharkov, on several pulses ; also found at Stavropol ; (21) *Baris chloris* Fabr. greatly injured (up to 80 %) kohlrabi, the larvae devouring the whole of the stems ; rarely met with on the roots ; at Kharkov the insect caused serious injury to cabbages ; (22) *Apion* sp. attacked clover, at Orel ; and was found throughout Riazan ; at Tula the number of larvae which usually feed on clover had considerably diminished, in 1914 according to Sazonko, the excessive drought retarding development and flowering of the clover, and consequently a part of the generation of the clover weevil was displaced in its life cycle ; according to STCHERBAKOV'S data obtained at the agricultural experiment Station of Chatilov (government of Tula), *Apion* is harmless agriculturally, and cannot be deemed to have any adverse influence on the production of clover seed ; at Tchernigov the weevil was found on a

clover field, causing a continuous falling off in production; (23) *A. pomonae* Fabr. was found at Kharkov in small quantities on peas and vetches (with *Sitones lineatus*); (24) *A. cracca* L., at Riazan, was observed on vetches and oats; (25) *Melolontha melolontha* L. was noted at Orel, Kuorsk, Kharkov and Ekaterinoslav; (26) *Anisoplia austriaca* Herbst caused great injury at Kharkov, Ekaterinoslav and Kherson; it was observed at Stavropol and in Bessarabia; (27) *A. crucifera* Herbst, at Kaluga, caused little harm; at Riazan, more extensive damage; (28) *A. segetum* Herbst appeared in hosts during the flowering of the rye but occasioned no injury; they were also observed at Stavropol; (29) *A. cyarthisera* Scop. was recorded at Stavropol; (30) *A. agnata* and *A. ferraria* were abundant in Astrakhan at the time of earing of the wheat and rye; (31) *Epicometis hirta* Pod. and *Oxythyrea funebris* Pod. in Bessarabia, devoured the ears of rye, and *O. funesta* the flowers of wheat; (32) *Pentodon idiota* Herbst, at Ekaterinoslav, Kherson and in Bessarabia, caused injury to maize; at Kiev, it was found in a ditch surrounding a beet field.

II) LEPIDOPTERA. — (1) *Ochsenheimera taurella* Schiff. caused extensive damage at Orel, Riazan and Kaluga; (2) *Talis quercella* Schiff. destroyed several hundred acres of pasture in April and May at Astrakhan; (3) *Phlyctaenodes sticticalis* L. was observed in small numbers at Riazan on the grass, and in an oak forest; damage not noted; a few at Kharkov, injuring beets in some localities; also a few at Kiev; at Ekaterinoslav the larvae injured maize; fewer in Bessarabia than in 1912 and 1913, and observed on lucerne; hardly noticed in the Crimea; at Kherson (experimental field) the lucerne was completely destroyed, and rye half destroyed; at Ekaterinoslav, the first generation larvae injured the beet sowings; a normal number also seen at Astrakhan; (4) *Pyrausta nubilalis* Hb., caused great damage at Riazan to hemp, which was completely destroyed in some localities; injury noted at Kiev to maize, millet, and once to mustard; apparently the larvae also injure the sunflower; in Bessarabia, in the government of Tchernomorsk, and at Ekaterinoslav, this insect did extensive damage to maize; at Ekaterinoslav in some localities, the injury destroyed the entire crop; (5) *Acronycta rumicis* L., at Kiev, observed in the larval form on the leaves of the ornamental sunflower, the raspberry bush and *Rumex acetosella* Willd.; also found on maize and on vine leaves; (6) *Plusia gamma* L. was noted at Kiev, adult in spring wheat sowings, and larvae in beet fields also reported at Astrakhan and in Bessarabia; (7) *Trachia (Hadenia) basilinza* Tb. observed at Orel, at Riazan (on rye ears and in grain); likewise at Kaluga and Ekaterinoslav, where it occurred widely (the young larvae found on oats); (8) *Hydroecia nictitans* Bkh., in considerable quantities at Tver, Tula, Orel, Riazan and Kaluga; (9) *Oria (Tapinostola) musculosa* Hb. at Ekaterinoslav was one of the insects causing most havoc to grain crops in 1913, 376,560 acres were attacked; in 1914 the insect was found nearly as plentifully as in the previous year, but involving a larger area: of 754,021 acres of spring cereals, 200,560 were damaged or destroyed, i. e. about 25%; M. VITKOVSKIJ gives the following features observed in the growth of the insect: (a) early emergence of the larva (first injuries noted 4th April

b) variations in the date of emergence of larvae (11th May in the Pavlograd district, the smallest larvae were observable and also these ready to accomplish the next phase of development); (c) larva passing into the open in spite of heat; the death of the insect observed to be due to parasitic hymenoptera and an unknown cause; the same worker observed a fresh kind of damage caused by the insect: on examining the field attacked one is struck by the completely dried and whitened ears, the grain has not formed, at the upper internode the stalk of the ear is destroyed, on the leaf sheaths the inlet and exit holes of the insect are found; at Kharkov it injured spring wheats, barley and oats, up to 90 % of the crop; damage was also observed in the Crimea; in the Don region the insect injured 2725 acres, 750 acres being completely destroyed; (10) *Euxoa (Agrotis) tritici* L., at Astrakhan injured spring cereals; (11) *Euxoa (Agrotis) segetum* Schiff. observed at Riazan, Kaluga, Orel, Kharkov, Kiev; damage found on some farms of Voronej and Poltava, and in Podolia serious damage at Ekaterinoslav, Samara and Saratov; the insect observed at Astrakhan and in Bessarabia; (12) *Feltia (Agrotis) exclamatoris* Schiff. noted at Riazan; (13) *E. segetum* and *E. exclamatoris* are two competing species as regards time of flight, and one preys on the other; at Tula the number of *E. exclamatoris* almost exceeded that of *E. segetum*; (14) *Episilia (Agrotis) simulans* Hufn. noted at Kiev on rye and on beet leaves; the larvae destroy the stalk almost level with the ground, the plant then falls and is completely devoured.

III) HYMENOPTERA. — (1) *Cephus pigmaeus* L.: a small number observed at Riazan; also noted at Orel, Ekaterinoslav, in considerable quantities; at Kherson it occurred everywhere in the same amount as in previous years; also noted at Stavropol; (2) *Athalia spinorum* Fabr. at Kiev, according to the observations of V. M. KOSTINSKIJ, oviposited on the edge of hemp leaves; at Kharkov, Kherson and Astrakhan it damaged hemp and turnips; (3) *Bruchofagus gibbus* Boh., at Orel, caused much damage to seed clover.

IV) DIPTERA. — (1) *Hylemyia (Leptohylemyia) coarctata* Fall., at Orel, occasioned less injury than in 1913; at Kiev the damage to the sowings of spring wheat was 10 %; the rye sowings suffered 12.5 to 15 %; (2) *Agromyza horum* Fabr. noted among injurious insects at Kiev; (3) *Oscinella frit* L., observed at Ufa, Orenburg, Smolensk, Moscow and in Livonia; at Orel, it wrought much havoc to spring grain crop sowings; the early sowings (25th July) of rye and barley suffered more than the late (17th August); traces of damage were found at Riazan; at the agricultural experimental station of Chatilov (province of Tula) STCHERBAKOV observed injury occasioned by this dipteran to maize, the damage being of the typical character of that occasioned to grain crops; the maize plant was not destroyed, it had a very strong stalk and in this way proved its capacity to produce a good cob; at Kiev, the insect caused injury to spring cereals; in some localities, in April, the injury was 44 % of the sowings; this dipteran did damage at Ekaterinoslav; inconsiderable injury was observed at Kherson on oats and barley, and on some farms in Podolia; (4) *Chlorops taeniopis* Deig. was noted at Riazan and Orel; it seems to be widespread at Ekater-

noslav and to attack barley by preference; on the 11th June VITKOWSK observed a new injury caused by the insect: it attacks the growing but upward growth is checked, the plant swells abnormally and becomes monstrosity, the height of these monstrosities does not exceed 6 inches while the neighbouring plants attain 2 ft. 3 ½ inches and more and have already eared; the monster stalk attains 9 to 12 centimeters in diameter; (5) *Cidomyia destructor* Say was observed at Perm, Ufa, Riazan, Tula and Ekaterinoslav; at Orel it injured the spring wheat and rye; was reported on some farms in Podolia and in the Crimea; (6) *Lasioptera cerealis* Lind. found at Orel and Riazan; in the latter government it was accompanied by *Oscinella frit* L.

V) HEMIPTERA. — (1) *Aelia acuminata* L. and *Eurygaster maura* L. occurring very widely at Riazan; the last named species was observed on rye ears; the insect was found beneath stacks (40-56 individuals found beneath two stacks in the district of Mikhailovsk); the migration of the insect to the forests began in the middle of July, and the number there had increased from the middle of August; (2) *Aelia acuminata* and *E. integripes* Put. were found on cultivated plants at Stavropol; (3) *Eurygaster* sp. was recorded among injurious insects at Orenburg; (4) *Trygonotylus ruficornis* Geoff. was observed at Riazan and Stavropol; (5) *Adelphocoris lineolatus* Geoff. at Kiev, was seen by VASILIEV to feed on the nectar of the flowers and juice of the floral buds of the mallow; at Ekaterinoslav it devoured lucerne, and at Kherson it was found on the same plant; at Kuban it was found on beet sowings; it is mentioned among injurious insects at Stavropol; (6) *Macropsium granaria* Kirby, at Riazan, where it was found on the leaves of rye, wheat and oats (the aphid sucked the juice from the leaf and the base of the ear); on the glumes of oats, the insect produced white spots and caused reduction of the grain; the attacks were in the proportion of 20 to 25 %; at Ekaterinoslav the aphid was found on the leaves and ears of barley; (7) *Pentaplis trivialis* Pass. was observed in large quantities on the roots of barley at Ekaterinoslav; it was also reported in the Crimea; (8) *Taroptera graminum* Rond.; at Ekaterinoslav, severely attacked barley and oats; (9) *Tetraneura rubra* Lich.; was observed at Ekaterinoslav and in the government of Tchernomorsk; (10) *Brachycolus noxius* Mordw.; presence recorded in the Crimea; damage not so extensive as might have been expected at the beginning of spring, which is to be put down to the strength and uniformity of growth of the grain crops.

VI) ORTHOPTERA. — (1) *Pachytylus migratorius* L.; at Orel a small number were found, and also at Riazan; at Kharkov, on the 9th July at 10 p. m., the flight of a considerable swarm of these insects was observed; at Ekaterinoslav the insect was noted on maize (with *P. doneus* L.); at Astrakhan locust control was organised in a locality where they covered 102 ½ acres, the cost was about £ 30; the same control was undertaken at Stavropol, Ekaterinodar, Baku and Elisavetpol; (2) *Calliptamus italicus* L. caused injury at Saratov and Astrakhan; (3) Locusts (species not identified): at Orenburg locust control was organised from 15th May

at the beginning of July, the cost exceeding £ 400; the same was done at Baku, Elisavetpol, Ekaterinodar and in the region of Tourgaïsk.

VII) THYSANOPTERA. — (1) *Anthothrips aculeatus* Fabr. was met with frequently on rye ears at Kaluga; (2) *Haplothrips tritici* Kurd. and *Haplothrips graminum* Usef. were observed in considerable quantities; the former sucked the glumes and grain of rye, the latter was found on oats and seemed to lead to whitening of the ears; in June and July *H. tritici* was found in quantities on the inflorescences of red clover (it was less frequent on white clover); at Tchernigov, it was observed that the Thysanoptera had been carried away from the land where previously found, through the agency of red clover roots; at Ekaterinoslav they occurred very rarely and attacked wheat and oats (in the latter case, *H. tritici*); at Astrakhan these Thysanoptera caused injury to wheat, and were found very extensively on this crop in Bessarabia.

VIII) INSECTS ATTACKING SPECIAL CROPS. — (A) Beetroot — (1) *Thynoderes punctiventris* Germ., at Kiev, in 1914, as in the previous year, was found in smaller numbers, so that no control measures were organised on many farms; at Kharkov, Tchernigov, Ekaterinoslav and Ekaterinodar, caused injury; (2) *Lixus ascanii* L.: at Ekaterinodar, M. VASILIEV found its eggs, yellow in colour, on the stalks of *Amaranthus blitum* L. with which a beet field was severely infested; (3) *Psallidium maxilosum* Fabr. observed at Ekaterinoslav; (4) *Tymannus palliatus* F. noted at Kiev; *Liparus coronatus* Goeze found on May 14 in the small ditches surrounding the beet; on the 17th May it was observed that the eggs had been laid in the soil; on the 29th May some eggs were found near the roots of a carrot; on the 8th June the eggs were found laid on carrot roots; at the end of June larvae appeared, and on the 1st September they returned into the ground; the adults devoured the leaves of the beet (beginning with the pith of the midrib) and the carrot (eating transversely); (6) *Cassida nobilis* L. noted at Kiev; (7) *Castroidea polygoni* L. noted at Kiev; *Thanatophitus sinuatus* L. at Kiev; the larvae injured the crops of beet and *Chenopodium album*; in the laboratory of the agricultural Station of Smielna, the adults readily eat the leaves of the beet; (9) *Aphis myri ramificis papaveris* F., at Kiev; the insect was found on the upper and under surface of beet leaves; viburnum and jasmine are centres of propagation of this aphid on the beet; VASILIEV found females of this insect on the roots of beets left on the field after the crop; (10) *Macrosiphum circumscriptum* Busckton, at Kiev, found on the beet; (11) *Lygus pratensis* L. came to winter in the adult form; VASILIEV found this insect, in 1913, on the upper part of the root stock of rotted beets which had lain on the ground through the winter; on the 18th July 1914, eggs were found on a fenestalk; (12) *Piesma capitata* Wolff., at Kiev, this insect had laid its eggs on the lower part of beet leaves in spring and summer; there are 2 generations and the adults of the second hibernate; on the 3rd August VASILIEV found the insect feeding on the nectar of the mignonette; (13) *Bibio ulani* L. and *Bibio marci* L. at Kiev, the former in small numbers, but

the latter in considerable quantities in April; at Astrakhan both species appeared, and they were numerous throughout the government.

Among other insects injuring the beet, there were also observed, at Ekaterinodar, the "earth fleas" (*Halticini*) and the larvae of the coel chafer. Other insect pests of the beet are indicated above.

(B) *M u s t a r d*. — At Astrakhan, *Plutella cruciferarum* Zell. injured this plant in the region of Jimkursk; in June, about 2750 acres were destroyed; the presence was also observed of: *Pieris daphidice* L., *P. rapae* L., *Colaphus sophiae* Schall., *Phyllotreta cruciferae* Goeze, *Athalia spinaria* Fabr., (*Pyrausta nubilalis*, at Kiev, was referred to above).

A list of 32 publications accompanies the paper.

824 — **Diaspids Collected in Southern Italian Somaliland.** — MALFENOTTI PIETRO in *Rivista* Vol. IX, Part 2, pp. 321-358, Pl. VIII-X. Florence, March 24, 1916.

Description of the diaspidids gathered in 1913 by the Stefanini-Pardi Scientific Mission, in Southern Italian Somaliland:

(1) *Aspidiotus* (*Evasp.*) *destructor* Sign. (= *A. transparentis* Green *A. translucens* Ckll.), on leaves of *Cocos nucifera*, at Merca, and on leaves of *Xylocarpus obovatus* near the mouth of the Djouba, June 1913; (2) *A. (Evasp.) cyanophylli* Sign., on leaves of *Manihot Glaziovii* at Djélib on the Djouba, June 1913; (3) *A. (Evasp.) orientalis* Newst. (= *A. osbeckiae* Green *Chrysomphalus pedroniformis* Ckll.) on branches and fruits of *Calotropis procera* and on fruits of *Solanum arund.* at Moukdicha, May 1913; (4) *Chrysomphalus rossi* (Mask.) Ckll. var. *ferrandii* Malen. n. var., on leaves of *Garcinia somalensis*, November 1913, at Lough, where the host goes by the name of "Ferrandi tree"; (5) *C. Piceus* Malen. n. sp. very numerous on leaves of *Cassine Schweinfurthiana* (?), called by the natives "Calangcal" at Aden Caboba, October 1913; (6) *Pseudaonidia quadriareolata* Malen. n. sp., on the bark of *Acacia Asak* at Allengo, September 1913; (7) *P. articulata* (Morg.) (= *Selenaspis articulatus* Morg.), on leaves of *Xylocarpus obovatus* at Djumbo, near the mouth of the Djouba, and on leaves of *Salvadora persica*, June 1913; (8) *Hemiberlesia fissidens* (Ldgr.) var. *constricta* Malen. n. var., on leaves of *Rhizophora mucronata* at Djumbo near the mouth of the Djouba, 13th June 1913, and on leaves of *Hyphaene pyrifera* Beccari with *Chionaspis pseudo-nivea* Malen. n. sp. on the shore of El Saï, 21st June 1913; (9) *Parlatoria (Websterella) blanchardi* (Taig.) on date palms, at Merca, 6th June 1913; (10) *Dinaspis reticulata* Malen. n. sp., on leaves of *Dobera Macalusoi* at Quambatti, November 1913 and on both leaf faces of an undetermined member of the Capparidaceae, at Mallable, 28th July 1913; (11) *D. reticulata* var. *minor* Malen. n. var., on both leaf faces of *Balanites somalensis* near Matagassile, 24th September 1913; (12) *D. berlesii* Malen. n. sp., on the under surface of the leaf of a member of the Capparidaceae, perhaps of the genus *Cadaba* at Biobahal, on the Djouba, 26th September 1913; (13) *Chionaspis usambarica* Ldgr., on the under surface of the leaves of *Xylocarpus obovatus* at the mouth of the Djouba, September 1913; (14) *C. elongata* Green, on the under surface of the leaves of *Cassine Holstii*, near Djumbo, 12th June 1913; (15) *C. pseudo-nivea* Malen. n. sp. on leaves of *Hyphaene pyrifera*, with a

number of individuals of *Hemiberlesia fissidens* (Ldgr.) var. *constricta* Malen. on the shore of El Saï. 21st June 1913; (16) *C. paolii* Malen. n. sp., on the leaves of *Mariscus chactophyllus* at Bour-Meldac, 23rd July 1913; (17) *Lepidosaphes* (*Coccomytilus*) *somalensis* Malen. n. sp., on the trunk bark of *Acacia Asak* with *Pseudaonidia quadriareolata* Malen., at Allengo, September 1913.

Some Miscellaneous Economic Insects found in New Jersey. — WEISS HARRY B., in *the Canadian Entomologist*, Vol. XLIII, No. 4, pp. 141-143, London, April 1916.

Callopietria floridensis Guen. ("Florida fern-cutworm"). — This insect, a lepidopteron already recorded by the Author as doing considerable damage to ferns in greenhouses, was found to be effectively controlled by spraying with fresh pyrethrum, one ounce to one gallon of water, plus one half ounce of soap. Also applied with a bellows with similar results.

Phytomyza chrysanthemi Kowarz ("Chrysanthemum leaf miner" or "marigold fly"). — This insect does considerable damage to chrysanthemums in various greenhouses in northern New Jersey. The larvae mine the leaves. Nicotine solutions are effective against this insect, in place of the more or less unsatisfactory method of picking off and destroying infested leaves.

Otherea tripunctata Svederus ("dogwood twig-girdler"). — This coleopteron causes withering of the leaves of *Cornus florida* at the tip of the infested shoot. It is widely distributed in New Jersey, but as a rule does not occur in sufficient numbers to do any considerable damage.

Hemichionaspis aspidistrae Sign. — In many fern houses in New Jersey this scale insect is a dangerous pest. It is also continually introduced on *Aspidistra* plants imported from Belgium. There is no satisfactory remedy, and infested leaves are usually pulled off and destroyed during retreating or turning over the stock.

Isisoma orchidearum Westw. ("Cattleya fly"). — This Chalcid, known as the Cattleya fly, deposits one or more eggs in the buds of Cattleya, and development and pupation take place inside. The pest is found in practically all orchid houses of New Jersey where Cattleya species are grown, and is also continually introduced in orchids imported from South America. Mitigation with nicotine extracts is recommended to kill the adults.

Aphrophora parallela Say and *Cecidomyia resinicola* O. S. — Observed on pine trees in nurseries, but no injuries to the trees could be detected.

Corythucha arcuata Say. This lace bug is found on the leaves of oaks and other trees in various parts of New Jersey.

***Diplogaster labiata* n. sp. and *D. aerivora* n. sp., Nematode Parasites of *Saperda tridentata* and *Leucotermes lucifugus*, in Kansas.** — MERRILL J. H. and FORD A. L., in *Journal of Agricultural Research*, Vol. VI, No. 3, pp. 115-127, Fig. 1-3, Washington D. C., April 17, 1916.

A description of the life cycle and habits of two new nematodes *Diplogaster labiata* and *D. aerivora*, found as parasites of *Saperda tridentata* Oliv. (elm borer") and of the white ant *Leucotermes lucifugus* Rossi.

D. labiata lives in the digestive canal of *Saperda*. The numbers present therein are so large that the walls of the intestine are broken, the abdominal cavity is invaded, and the death of the insect caused.

The individuals of *D. acrivora* live as parasites in the cephalic region of *Leucotermes*; they are more numerous in the neighbourhood of the mouth parts. Their number ranges from 1 to 75 per insect.

Experiments undertaken in order to ascertain whether the nematodes can be introduced into the body of the *Leucotermes* and produce the parasitic affection artificially gave positive results. White ants brought into contact with cultures of nematodes in wet soil were infected and died in 12 days.

827 - **The Efficacy of *Aphelinus silvestrii* in Control of *Chrysomphalus dictyospermi*, in Sicily.** - DE GREGORIO A. in *Nuovi Annali di Agricoltura Italiana*, VIIth year, VIIth Series, Part I, pp. 18-19, Palermo, January-March 1916.

In confirmation of his previous observations (1) the writer reports that in the neighbourhood of Palermo he observed so considerable an increase of *Aphelinus silvestrii* that the latter almost completely destroyed the famous citrus scale insect *Chrysomphalus dictyospermi* for which he proposed the new name of *Aspidiotus agrumicola*. This scale insect has not yet entirely disappeared, but the hymenopteron, its natural enemy, has reduced it so such an extent that it no longer causes injury to the plants or their fruits.

828 - **Efficacy of Various Arsenical Preparations in Control of Insect Pests.** - BATTARJ in *Le Progrès agricole et viticole*, 33rd year, No. 101 pp. 148-152, Montpellier, May 7, 1906.

The arsenic salts most in use as insecticides are: sodium arsenate, calcium arsenate, lead arsenate, copper arsenite, iron arsenate and copper arsenate. Their toxic action is in proportion to their content of arsenic. We have therefore:

Calcium arsenate	37.9 "	of arsenic
Lead "	16.7 "	"
Anhydrous sodium arsenate	36.0 "	"
Copper arsenite	34.5 "	"
Iron arsenate	33.0 "	"
Copper "	32.0 "	"

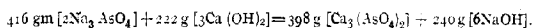
This scale of values, however, is slightly modified in practice for several reasons, the chief of which are: the solubility of the arsenic salt, the formation of salts which act as though they were impurities and lower the percentage of arsenic in the compound, the presence of chlorides, and the addition of Bordeaux mixture for the purpose of controlling mildew at the same time.

Sodium arsenate is the most soluble, but its action is transitory, and it may seriously burn the green parts of the plants as soon as the dose of 1 per 1000 is exceeded; it is therefore only used in the preparation of the other arsenical compounds.

Calcium arsenate is the richest in arsenic and is also the most effective

(1) See *I.*, April 1915, No. 151.

tive in application. It is obtained by the reaction of milk of lime on a solution of sodium arsenate, viz :



The result is 398 grams of arsenate of calcium and 240 grams of soda or 638 gr. of substances containing in all 150 gr. of arsenic, or 23.5 %.

The presence of the soda, which remains adhering to the leaves after evaporation, therefore reduces the toxic value of the compound 38 %

23.5
37.9

For the rest, a large proportion of the soda may be allowed to settle at the time of preparation, and if care is taken to use an sodium arsenate absolutely free from chlorides, the calcium arsenate will be superior to all other preparations of arsenic. The most suitable proportions are : 500 gr. of sodium arsenate and 200 gr. of fat lime or 380 gr. of calcium hydrate.

In arsenate of lead the toxic property of the arsenic is added to that of the lead, so that its insecticidal action is in no way inferior to that of arsenate of calcium, but it is much dearer and much more difficult to prepare. It is obtained by allowing a solution of lead acetate to react on sodium arsenate. The percentage of arsenic in the product is 10 %.

The copper arsenite is obtained by allowing trisodium arsenite to react on a solution of copper sulphate; the content of arsenic in the product is 17.4 %.

Finally, iron arsenate and copper arsenate are obtained by causing sodium arsenate to act on a solution of iron sulphate or sulphate of copper; the percentage of arsenic in the product is 17.2 and 16.4 respectively. In spite of the impurities which form in the preparation of the mixtures, calcium arsenate is therefore much more active in proportion than all the other preparations of arsenic.

The presence of chlorides weakens the properties of the insecticides. These chlorides may very well be contained not only in the arsenate of sodium, but also in considerable quantities in water, especially in well water (0.5 to 3 gr. per litre). It is therefore preferable to use running water as far as possible.

To the arsenical preparation Bordeaux mixture is often added, reducing its toxic action. In a 1 % mixture the weight of the precipitated hydrate of copper oxide is 385 grams per hectolitre; on the other hand, the arsenical mixture obtained with milk of lime and separated from the sodium water contains 398 gr. of arsenical precipitate with a content of arsenic of 24 % (150 gr.). By mixing the two precipitates, a total weight is obtained of 783 gr. with only 19 per cent of arsenic.

80 - The Efficacy of Hot Water Treatment against "Cochylis and "Eudemis,, — TORI MARINO in *Rendiconti delle sedute della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, 5th Series, Vol. XXV, 1st Half Year, Part 7, pp. 524-528. Rome, April 2, 1916.

M. SEMICHON, who proposed this treatment, declared it effective against eggs and larvae of *Cochylis ambiguella*, *Polychrosis botrana* and *Spargano-*

nothis pilleriana; against aphids; fungi with external mycelium (oidium) and the external fructifications of the fungi. The writer's experience was confined to the summer generation of *Conchylis* and *Polychrosis*, especially their eggs. Experiments were carried out both in the fields and the laboratory, chiefly with water at 55°-56° C. The results obtained lead to the conclusion that the proposed sprayings with hot water only, at such a temperature that it cannot injure the plant (1) are almost entirely ineffective against the eggs of *Polychrosis* and *Conchylis*. The effectiveness against the larva is very doubtful. In any case they could hardly be reached, being sheltered in the floral buds or even inside the grapes. Only an immersion for 10 minutes in water at 65° C. (probably even only at 55°), is found sufficient to sterilise the eggs. It does not appear possible to make any practical application of this result.

830 - **Bridge Grafting for saving Fruit Trees with Injuries due to Animals or Mechanical Causes.** — See No. 758 of this Bulletin.

831 - ***Triænodes bicolor* and *Hydrocampa nymphæata* in the Rice Field of the Province of Milan, Italy.** — SUPINO F. in *Rendiconti del Reale Istituto Lombardo di Scienze e Lettere*, Series II, Vol. XLIX, Parts II-III, pp. 108-114. Milan, 1916.

The study carried out in the rice fields of the environs of Milan in relation to the aquatic larvae which, according to farmers, caused more or less injury to rice, proved the existence of three different insects: *Stratiom chameleon* L., an absolutely harmless dipteran, and two injurious species *Triænodes bicolor* Curt. and *Hydrocampa* (*Nymphula*) *nymphæata* L.

Triænodes bicolor (order Neuroptera, sub-order Trichoptera, family Leptoceridae). — The larva of this insect cuts the leaves of aquatic plants for use as a sheath or cover and in the rice fields uses the rice leaves for this purpose, partly destroying them.

Hydrocampa (*Nymphula*) *nymphæata* (order Lepidoptera, family Pieridae, sub-family Hydrocampinae [*Nymphulinae*]). — This is one of the rare lepidoptera the larvae of which live in water; this larva also cuts the leaves to make a sheath for itself; but what is more important and renders it more injurious than that of the *Triænodes*, is that it attacks not only the rice leaves, but also the young plants, feeding on them.

For control, it is advised to put carp in the rice field. They destroy a large number of the larvae, as was ascertained several times with certainty.

832 - ***Tychius quinquepunctatus*, a Coleopterous Pest of Beans in Apulia, Italy** — G. GRANDI, in *Bollettino del Laboratorio di Zoologia generale ed agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. X, pp. 103-119, Fig. 1-6. Portici, March 18, 1916.

In April 1915, there was an extensive invasion of *Tychius quinquepunctatus* L., in the bean fields of the commune of Ruvo di Puglia. The adults feed on the parenchyma of the soft leaves and young pods of the bean. Mating occurs in the first half of April, and the females oviposit in a hole or tunnel previously bored with their rostra in the wall of the pod. As soon

(1) Tests have shown that on thoroughly wet leaves with water at 65°C., burns are produced on the young and even on the adult leaves.

as the larvae hatch they gnaw away the outer seed cover, and through the caruncle or at any point of the seed they enter the cotyledons which they gnaw and crush easily with their strong biting jaws. The injury they thus cause is very serious, and in the case of extensive infestations the loss may be 50 % or even 75 % of the entire crop.

Unfortunately no natural enemies of this member of the *Curculionidae* are yet known. Resort must therefore be had to artificial means of control. Among the most effective there are recommended: 1) disinfecting the ground by injections of carbon disulphide; these injections must be made immediately after the crop, to the amount of 30 to 50 cc. of liquid per square metre; this destroys the larvae and pupae, but care must be used and the necessary precautions taken in the neighbourhood of any trees; 2) bean cultivation should be replaced by some other for some years; this is advisable when feasible economically, and may be made so if all the farmers of the region without exception arrange to take this step.

33 - *Ligyris fossator* and *L. fossor*, Coleoptera attacking Sugar Cane, in Brazil.
— *Chacaras e Quintais*, Vol. XIII, No. 4, pp. 248-249, Fig. 1-83. St. Paul, April 15, 1916.

The northern States of the Brazil Union have for a long time deplored the grave injury caused to sugar cane plantations from time to time by coleoptera called "bezouros dos canaviaes", sometimes causing destruction of the crop. Dr. CARLOS MOREIRA, chief of the Laboratory of Entomology of the National Museum of Rio de Janeiro, was instructed by the Ministry of Agriculture to study these insects. His researches at Pernambuco proved that the "bezouros" of the sugar cane plantations are numerous, but that the most injurious of all is *Ligyris fossator* Dejan. the larvae of which, called at Pernambuco "pão de galinhas" because hens are very fond of them, live in the soil and gnaw all the rooted fragments of cane within their reach. This same parasite of the sugar cane has already been reported in French Guiana.

There are advised as means of control: 1) injections of carbon disulphide; 2) flooding and subsequent drying of the soil; 3) turning over the soil and collecting all the larvae by hand; 4) use of light traps for capturing the adults.

A sure and cheap means for destroying a large number of larvae is based on the fact that after heavy rains pools of water form in the lower parts of the plantation. The larvae beneath die of asphyxia. When the soil dries up, the larvae gather at its edges in search of moisture. They may then be destroyed in large numbers by burning straw at the point where the moisture has barely disappeared. In order to destroy the larvae farther away from the surface, the ground must be flooded or watered with distillery residue, or carbon disulphide injected.

At Allagás the sugar cane is also injured by another coleopterous insect *Ligyris fossor* Latr., which is controlled in the same way.

The sugar cane is also attacked by scale insects which live on the culm, chiefly beneath the leaf sheaths, and which cause extensive damage when they get near to the rooted cane fragment or pass into the roots. To destroy

these parasites a piece of cane must, before planting, be steeped in a solution of calcium sulphide of 5° Beaumé strength or a 2 % emulsion of soap and kerosene, for 15 minutes.

- 834 - **The Leopard moth (*Zeuzera pyrina*), a Dangerous Imported Insect Enemy of Shade Trees in the United States.** - HOWARD L. O. and CHITTENDEN F. H. in *United States Department of Agriculture, Farmer's Bulletin* 708, pp. 1-10, Fig. 1-4. Washington, D. C. February 14, 1916.

In the Hudson Valley and on the Atlantic seaboard, from Massachusetts to New Jersey, shade and ornamental trees and shrubs of many kinds, with the exception of evergreens, are severely injured by the larvae of the lepidopteron *Zeuzera pyrina* Fab. (*Z. aesculi* L., *Z. decipiens* Kirby), a European species accidentally introduced a short time since in the United States.

These larvae mine long tunnels in the living wood and stop growth to such an extent as to cause the death of the plant, especially in young trees.

In any case the presence of these tunnels weakens the trees, so that they are less able to withstand wind pressure, and also opens a path for other insects or germs of the most varied diseases.

The trees attacked are not only the horse chestnut, chestnut, walnut, oak, maple, alder, birch etc., but also fruit trees, such as pear, apple and plum trees, etc.

Some birds and mammals are among the most effective natural enemies of these insects.

Artificial means of control : 1) cutting and destroying the infested wood; 2) injecting carbon disulphide into the tunnels bored and afterwards blocking up the apertures very carefully; 3) lighting very bright fires in those parts where the insects abound; the pests will be attracted by the light and fall into specially arranged pans filled with water and petroleum.

- 835 - ***Pseudococcus citri*, *P. bakeri*, *P. citrophilus* and *P. longispinus* in the Citrus Plantations of Southern California.** - CLAUSEN CURTIS P. in *Agricultural Experiment Station, Berkeley, California, Bulletin* No. 258, pp. 1-48, 8 Figs. Berkeley, 1917.

Four species of *Pseudococcus* : *P. citri* Risso, *P. bakeri* Essig, *P. citrophilus* Clausen Mss. and *P. longispinus* Targ. are particularly injurious to citrus trees in Southern California, especially in the seaboard region, where the moisture and heat conditions favour their growth. On the other hand the outbreaks become more and more sporadic and rare in the interior.

(1) *P. citri* Risso. - First reported in 1880 in the county of San Diego whence later on it spread into the countries of Orange, Los Angeles, Ventura and Santa-Barbara. Owing to the considerable quantity of the juices which the adults take from the young branches and fruits, many leaves fall, and the fruits discolour and are very tardy in growth. At the time of flowering the insect frequently causes fall of the leaves and the barely set fruit. The larvae likewise occasion extensive havoc. They extract the sap and chlorophyll from the leaf cells and secrete a large quantity of honeydew, thus occasioning the appearance of a rich cryptogamic vegetation (*Meliola Camelliae*). The latter clogs up the apertures of the stomata, which hinders the functions of the leaves.

The principal hosts of *P. citri* are *Asparagus officinalis*; *Strelitzia gigantea* (bird of paradise flower); *Callistemon lanceolatus* (bottle brush); *Bouvardia* sp.; *Umbellularia californica* (California laurel); *Cestrum* spp.; *Citrus medica* var. *genuina*; *Coffea arabica*; *Coleus Blumei*; *Columbium* p.; *Gossypium peruvianum*; *Geranium* sp. (cranesbill); *Cucumis sativus*; *Canolhus integerrimus* (deer brush); *Cordylone terminalis*; *Hedera Helix*; *Fuchsia* sp.; vine; *Passiflora edulis*; *Jasmin*; *Plumbago* sp. (leadwort); lemon tree; magnolia; *Ipomoea Bona-nox* (moonflower); nettle; *Solanum Douglasii* (nightshade); *Nerium Oleander*; orange tree; *Panax monstrosa*; *Paeonia* spp.; *Solanum muricatum*; *Phyllanthus carolinensis*; *Euphorbia pulcherrima*; *Citrus decumana* (pomelo); potato; *Solanum jasminoides*; zourd; *Passiflora violacea*; *Sequoia sempervirens* (redwood); *Begonia* sp.; *Tacsonia jasminoides*; tobacco; *Cyperus alternifolius* (umbrella plant) and *Zebrina pendula* (variegated wandering Jew).

(2) *P. bakeri* Essig. — Was first discovered on *Sambucus glauca* (elder) in the neighbourhood of Santa Paula, county of Ventura, whence it made its way into the counties of Santa Barbara, Los Angeles, Orange, San-Diego, Riverside and San Bernardino.

The injuries it occasions are the same as those of *P. citri*. The larvae and adults attack by preference the tender leaves full of sap, where they gather in numerous colonies.

Hosts: apple; *Aesculus californica* (buckeye); *Umbellularia californica*; *Aleurites triloba* (candlenut); *Agave americana*; *Coleus Blumei*; *Cestrum* sp.; *Cordylone terminalis*; *Sambucus glauca*; ivy; *Enterolobium* sp.; *Erigeron canadensis* (horseweed); *Iris*; *Cydonia japonica*; lemon tree; *Lilium Parryi* (lemon lily); *Phaseolus lunatus* (Lima bean); *Choisya ternata* (Mexican orange); nettle; *Solanum Douglasii*; orange tree; pear tree *Solanum jasminoides*; *Salix* sp.; *Helianthus annuus*; walnut; *Grevillea robusta* (silk oak).

(3) *P. citrophilus* Clausen Mss. — First appeared in 1913 near Uplands, county of San Bernardino. Was mistaken for *P. citri*, causing much anxiety to the local fruit growers. The injury it causes is never serious. It may on most occasion the fall of some flowers or young fruits of the lemon tree and discolouring of the orange tree fruit, but always to a very limited extent.

Hosts: *Azalea*; *Rubus villosus*; *Ficus pumila* (climbing fig); fig tree; hy; heliotrope; lemon tree; orange tree; mallow; *Choisya ternata*; *Brassica nigra*; *Solanum Douglasii*; *Schinus Molle* (pepper tree); *Chenopodium album* (pigweed); walnut; *Melilotus alba*; potato; *Rubus nutkanus*; rose bush; rhubarb; *Lolium perenne*; *Grevillea robusta*; *Helianthus annuus*. All these plants are not equally frequented. The presence of *Ps. citrophilus* is rather rare on some of them. Others, however, such as the potato, rhubarb and *Grevillea* are more often attacked than citrus plants.

(4) *P. longispinus* Targ. — Common throughout Southern California, in the counties of Santa Barbara, Ventura, Los Angeles, Orange and San Diego.

Hosts: *Begonia* spp.; *Strelitzia gigantea*; *Richardia africana* (calla);

Aleurites triloba; *Agave americana*; *Cineraria cruenta*; *Citrus medica* var. *genuina*; *Coleus Blumei*; *Epiphyllum* spp. (crab cactus); *Croton Tiglium*; *Cordyline terminalis* (dracaena); ferns; fig tree; *Flacourtia sepiaria*; *Fuchsia* spp.; *Erythea edulis* (Guadeloupe island palm); *Psidium Guajava* (guava); lemon tree, mango tree; *Ipomoea Bona-nox*; *Nephrodium amplum*; *Nerium Oleander*; *Opuntia* spp.; *Phormium tenax* var. *variegatum*; plum tree *Cycas revoluta*; *Platycerium* spp.; *Stangeria schizodon*; *Sterculia Gregori*; *Cyperus alternifolius*; *Zamia* spp. Chiefly tropical and subtropical species, introduced into California as ornamental plants.

Cordyline terminalis (dracaena) is chiefly injured by the adults, which sometimes gather in large numbers on the terminal buds and prevent growth.

Among the natural enemies of these species of *Pseudococcus* in California, there are: 1) *Sympherobius californicus* Banks (brown lacewing) the female lays its eggs on the leaves and the fruits of the infested citrus plants, and the larvae emerging, like the adults, destroy a large quantity of *Pseudococcus*; 2) *Leucopis bella* Loew, the only really effective natural enemy of *P. citrophilus*; 3) *Cryptolacmus moultoni* Muls.: spread very slowly and with difficulty, and can only live in a few very limited coastal localities where it finds the conditions of moisture and temperature needed for its growth; 4) *Chrysopa californica* Coq. (green lacewing): its larvae attack the larvae and adults of *Pseudococcus*; 5) *Scymnus guttulatus* Lec. and *S. bipunctatus* Kugel: the latter was imported from the Philippines in 1910 and is now found in the counties of Ventura and Santa Barbara; 6) *S. marginicollis* and *S. sordidus* Horn.: the latter is the most effective species of *Scymnus* in controlling *Pseudococcus*; 7) *Chrysoplatycerus splendens* How., introduced from the Philippines into the county of San Diego and at present spread throughout Southern California.

Fumigation with hydrocyanic acid, and applications of various anti-fungus preparations, may give good results, but the best have been obtained by simple jets of water under high pressure at the rate of 44 to 66 gallons of water per plant.

836 - **The Woolly Whitefly (*Aleurothrixus Howardi*) in Florida Citrus Plantations.** — WATSON J. R. in *University of Florida, Agricultural Experiment Station, Bulletin* No. 126, pp. 81-102, Tallahassee, Fla., 1915.

Aleurothrixus howardi Quaintance, which was very probably imported from Cuba, was discovered for the first time in Florida in the neighbourhood of Tampa, in the autumn of 1909. In 1914 it had already reached the counties of Hillsborough, Pinellas, Manatee, Polk and De Soto, and will soon end in becoming common in all the citrus plantations of Florida.

Aleurothrixus causes damage in three ways to the plants attacked: 1) removal of juice from the tissues, causing the withering of the plant; 2) secretion of a honeydew which covers the leaves and fruits and forms a good medium for the growth of *Melissa Camelliae* and other fungi hindering the functions of the leaves and rendering washing of the fruit necessary; 3) the colonies of *Aleurothrixus* are a centre of attraction for the "purple scale" (*Lepidosaphes beckii*) so injurious to citrus plants.

Among natural enemies, "red fungus" (*Aschersonia Alcyrodis* Webber) and "brown fungus" (*Aegerita Webberi* Fawcett) grow badly on the *Aleurothrixus* and certainly cannot prevent its spread. The writer found on some lead larvae a *Cladosporium* (in the proportion of 80 %) which he considers to be the direct cause of their death, although he was not able to verify his hypothesis by inoculating living larvae with pure cultures.

The most effective and active natural enemy, however, is undoubtedly a small hymenopteron (*Eretmocerus haldemani*) the female of which lays its eggs in the body of the larvae or pupae of *Aleurothrixus*. The latter are then killed by the larvae hatching out of the eggs in their bodies.

As regards artificial means of control, good results are obtained by applying oily mixtures in the early days of March, the first half of June, about the middle of August and the beginning of November, when the parasites are in their early stages of development and more sensitive to insecticidal action.

The following formula is advised: to 8 lbs. whale oil soap add 2 galls. of fine paraffin oil, stirring vigorously all the while so that the whole is well emulsified. Add 1 gall. of water to the emulsion, stirring as before. Dilute emulsion to make 200 galls. of spray solution.

37. *Icerya purchasi* in Florida, United States. — WATSON J. R. in *University of Florida, Agricultural Experiment Station, Report for 1913*, p. 55. Tallahassee, Fla., 1916.

Icerya purchasi has continued to spread with continually greater rapidity. From August 1913 to March 1914, it was discovered in the following localities: St. Cloud, Key West, Odessa (Pasco County), Terra Ceia Island, Palmetto, Leesburg, Tavares, Ashton and Narcoossee.

The damage has been very serious, especially at Key West, where *Icerya* even attacks *Bursera Simaruba* (gumbo-limbo). This plant must be added to the list of hosts of this scale insect.

38. *Bombyx Pini*, a Spanish Pest of Pine (1). — MIRA JUNAKO in *Revista de Montes*, XIth year, No. 949, pp. 193-202, Madrid, March 15, 1916.

Reference is made to the extensive damage caused by *Liparis procerana* and *Bombyx pini* in the pine forests of the "Dehesa de la Albufera"; particulars given chiefly concern the latter insect.

Many trees entirely defoliated perished rapidly, especially in hot and moist regions where transpiration is more intense.

The control of the insects was undertaken by means of active and well organised measures, owing to which, by the resort to every available means, an enormous quantity of adults and larvae were destroyed, thus saving a considerable number of pines from certain destruction.

The following were the most effective means used:

1) Direct control by removal and destruction of the nests of the insects; hanging out white cloths at night, covered with a sticky substance and strongly illuminated; the adults, attracted by the light, are caught on the cloth;

(1) See also *R.* Jan. 1916, No. 130.

2) Spraying on the youngest, which are the easiest to get at, arsenate of sodium and quicklime, which safeguards the plants against further attacks (arsenate of sodium, 10.5 to 12.2 oz.; quicklime, 2.2 lbs.; water 2 galls.);

3) Coating the pine trunks over a more or less extensive area with a sticky pitch substance. The larvae coming down from the tree and then climbing up in search of food stop in front of the coated belt and can easily be destroyed. This is a very practical and easy method of control.

839 -- *Lyda hypotrophica*, a Hymenopterous Pest of *Epicea* in the Forests of Roggenburg, Germany. — Parts in *Zeitschrift für angewandte Entomologie*, Vol. 3, No. 1, pp. 75-96. Berlin, March 1916.

A very detailed description is given of the occurrence of *Lyda hypotrophica* Htg. (= *Cephaleia abietis* L.) in the forest of Roggenburg (Suabia) and the damage it has occasioned of recent years. These data are based on observations made in the Royal Forest District of Breitenenthal, but they are so characteristic that they may be considered as being likewise typical for the whole of Suabia.

In August 1911, in a stand of *epicea* 119 years old, in the southeast part of the said forest, many trees were remarked with their tops and side branches entirely stripped of needles. This fact was at first put down to the excessively dry weather in that year, but on felling some trees later, it was found to be caused by injury due to *Lyda hypotrophica*. In the month of September following, all the stands attacked where the insect was likely to be sheltered were studied, and the quantity of larvae contained in the soil was determined in 323 plots of 1 square metre each distributed over different points. It was found, in accordance with the literature of the subject, that stands of 60 to 120 years had suffered most, both with regard to infested area and number of larvae.

The chief object of these experiments was to determine how widespread was the occurrence of the insect in the forest. As however the majority of the larvae generally live in that part of the soil which is shaded by the largest trees, the latter were almost exclusively used for the experiments. The result is that this method only supplies maximum figures as to the presence of the larvae.

When in 1912 the Writer took over the management of the forest district of Breitenenthal, he hastened to obtain average figures as to the presence of larvae in the soil. He not only selected the plots in all parts of the forest, but he more than trebled their number. This was the more necessary, inasmuch as the first experiments had exhibited great variations in the number of larvae, even per unit of shaded area. There had been found in one district 2083 larvae per square metre of shaded area, while in another the number was only 480.

These experiments have shown that no stand throughout the total extent of the Royal forest district comprising 5683 acres was free from larvae, independently of the age of the trees. One stand alone showed an increase in the average number as compared with 1911; generally this num-

in the different districts was below that of 1911. The reduction was first put down to exceptional circumstances.

In order to secure exact data, the experiments were continued in the spring of 1913, on the same number of plots as in 1912. The number of larvae had again diminished.

The results obtained in the autumn of 1911, in March and April 1912, and in March 1913 for all the stands showing 200 or more larvae on the area shaded by one tree were compared with each other.

It was found that taking as a basis the number of larvae found in 1911=100, this number had fallen off 19.5% for the spring of 1912 and 47.5% for the spring of 1913.

From this it is evident that the number of larvae decreased in the course of the year observed by the Writer.

Control measures were only undertaken in 1913; therefore the reduction was due to natural factors. LANG has shown that in the forests of Upper Franconia, the larvae of *Raphidia ophiopsis* can attack the eggs and young larvae of *Lyda*. Yet the reduction in the number of *Lyda* could not be put down to this enemy, as it was only rarely found in the excrement of the insect. Traumatic causes, such as injury to the larvae, were also not responsible for the reduction in number. Nor were there more parasites. It was observed in 1912-1913 that a large number of larvae shut up for several weeks contained only a small number of ichneumonidae. The Writer, however, at the end of 1914, found ichneumonidae in some parts of the forest in no less numbers than the *Lyda* flying in June. The outbreak war however prevented him from ascertaining whether these ichneumonidae were connected with the appearance of *Lyda*. Quite possible there is connection, as BAER claims to have observed that the ichneumons (*Polyctis aethiops*) attack the almost full-grown larvae of *Lyda*.

The damage caused by *Lyda* to the epicea population of the forest Roggenburg was very great, but not sufficient to bring about the death of the trees. The tops which were bare the spring of 1912 regained their greenness, and in the following year the damage had to a great extent disappeared. Only the branches in the lower part and interior of the tree where the sunlight is very feeble, retained their bare appearance. Other circumstances, such as the presence of a large number of *Bostrichids*, were observed. It was likewise not possible to determine to what extent the growth of the trees had suffered through the influence of the insect. The increase in size depends primarily on the length of time during which the insect carried out its destructive work. It is generally supposed that the larva destroys the needles during June, July and the beginning of August and afterwards shelters in the ground. It is pointed out that this observation is only partly correct. There are some larvae which remain longer on the tree than others. In one case, the Writer observed that certain larvae continued to destroy the needles right up to December.

For effective control of *Lyda* it is essential to know in good time when they will fly. On the occasion of the flight in Upper Franconia it was observed that the larva of *Lyda* undergoes no external change before con-

version into a pupa. The skin of the larva only shrank a few days before it burst. It is pointed out that these changes were never observed by the Author, though he studied thousands of larvae. More precise indications on this question were given by SCHEIDTER, who found that the larvae which have attained complete maturity show deep black oval spots above the eyes, visible to the naked eye, which represent the eyes of the future pupa; they are called "Puppenaugen" (pupal eyes). In the months of April, May and June 1913, on the basis of this character there were examined 11 800 larvae from 8 different stands, and the number of those ready for transformation into pupae determined. It was found that this criterion is only partly correct. "Pupal eyes" do not appear only before conversion into pupal form, but as early as the previous autumn or summer. The larvae were found with pupal eyes in the month of August 1913.

This fact is important in practice, as by its aid it may be determined in the autumn whether or not there will be a great flight of *Lyda* in the following spring.

While observing the evolution of larvae into pupae the writer also ascertained the number of pupae in the above stands. Within a few weeks alone he found great variations in the number, which variations occurred at all points at the same time. The cause is probably the weather which exerts an influence on the transformation. A high temperature in April is found to favour the formation of pupae.

The perfect insect emerges very early from the soil, the emergence appearing also to be related to the weather. If the weather is rainy and foggy only a small number of adult insects are found, while on fine days they come out in large numbers. According to the writer mating generally takes place on the ground, on the leaves of *Gramineae* and very rarely in the crown of the tree.

With regard to *Lyda* control commenced in the forest of Roggenburg the Author remarks as follows: glue bands at a height of about 5 feet above the ground proved very successful at the beginning of flight. As female insects rarely reach the summit flying, most of them climbing up the tree.

Later on, when the weather allowed the insects to emerge in large numbers, and the ovaries of the females were full of eggs, the females traversed the band of glue without being captured. This observation is a contradiction with those of many investigators, and therefore the studies should be continued. The writer also made experiments with fly-papers and obtained excellent results. The high cost of this method of control however prevented him from repeating the experiments on a large scale. In any case they showed that a substance must be used with the properties of the glue used for catching flies if it is desired to obtain good results with glued bands or strips for controlling *Lyda*.

